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AN ANALYTIC STUDY OF THE MEMORY IMAGE AND THE PROCESS OF JUDGMENT IN THE DISCRIMINATION OF CLANGS AND TONES.

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INTRODUCTORY.

During the winter of 1897-98, the writer, then a student at Clark University, was attracted to the problem with which the present investigation deals by the observation of several rather unusual instances of 'pitch memory.' These observations led to an experimental investigation which was instituted with a view of analyzing qualitatively the structure of such processes of discrimination. The tests were, however, of an unsystematic nature, and were mainly restricted to personal observations conducted with the aid of a piano.

The more detailed and systematic study of the problem, the results of which are embodied in the present paper, was undertaken in the Psychological Laboratory at Cornell University during the academic years 1898-99 and 1899-1900. An added interest was given to the problem, and a favorable setting secured for the necessary experimentation, by the fact that there had just been completed in the same laboratory an essentially similar study in the domain of vision.¹

Since this article fully discusses the general bearing of the problem in hand, the present paper needs but little introduction. It may be well, however, to recount briefly the features of the preceding work which bear especially upon the prob-

¹I. M. Bentley: The Memory Image and its Qualitative Fidelity, this *Journal*, XI, 1899, 1-48.

lem, and also to make preliminary mention in this place of certain previous publications upon pitch memory which must necessarily be handled in some detail in the discussion of our results.

Setting out from Kuelpe's contention that much of the work on memory has assumed without sufficient cause the presence of a memory image, and that the term has been too loosely applied, Bentley has given a review of the literature bearing upon the memory image and the methods of its investigation, has discussed its genesis and function, and conducted an experimental study of the qualitative fidelity of memory images of color and brightness. He points out that the modern laboratory researches in this field have been chiefly pedagogic and popular rather than analytic in nature.¹

The chief methods for the study of the image are those of reproduction, recognition, comparison, and description. In view of the schematic nature of the reproduced elements, an important analytic problem is afforded if we seek to determine not how much of a given impression can be reproduced, but what is the nature of the centrally excited processes which form the basis of the act of reproduction or of recognition.

Both Wolfe² and Lehmann³ assumed the presence of a memory image in the recognitory consciousness; Hoeffding⁴ posited an unanalyzable 'quality of knownness' which had its physical substrate in a certain ease of molecular movement in the cortex; Washburn⁵ has advanced the hypothesis that recognition is a peculiar property of centrally excited sensations, possibly mediated by the excitation of connective brain tracts; Kuelpe⁶ has mentioned effectiveness for the arousal of centrally excited sensations *plus* a mood of familiarity; Baldwin⁷ the ease of motor adjustments of attention; and Wundt⁸ a feeling of recognition supported by a background of ideas.

Perception, like recognition, does not necessarily include reproduction, although it involves the past experience of the individual. We may arrange a schema of types of meaning-consciousnesses which shall show at a glance the part played by the image. Such a schema is given herewith:

i. Cognition (perception): no image introspectively discoverable.

¹ The articles of Philippe, *Rev. phil.*, Vol. XLIII, 1897, 481-493, *ibid.*, Vol. XLIV, 1897, 508-524, by their emphasis of the analytic study of the image for its own sake, form a pleasing exception to this tendency.

² *Phil. Stud.*, III, 1886, 556-558.

³ *Phil. Stud.*, V, 1889, 118-119.

⁴ *Vierteljahrsschrift*, 1899-90.

⁵ *Phil. Rev.*, VI, 1897, 267.

⁶ *Outlines of Psychology*, 1895, p. 172.

⁷ *Mental Development*, 1895, 313 ff.

⁸ *Phil. Stud.*, VII, 1892, 344 ff.

2. Recognition.

- A. Direct recognition : no image is necessary (whether the process be conducted with active or passive attention) save in the form of direct recall (memory in the narrow sense).
- B. Mediate recognition : when it involves conscious comparison an image is implied, but otherwise auxiliary ideas or other motives may be sufficient.

Bentley's experimental tests were conducted mainly by the method of recognition, with special precaution to secure knowledge of the presence or absence of the image just at the end of the time-interval. In the first series, conducted with open eyes, the observers did not try to hold the brightness image. Images were present in five-sixths of the tests. They could be recalled better at the end of five minutes than at the end of one minute. On the other hand, there were frequent instances of flash-like, absolutely certain judgments, where there is no trace of comparison and no vestige of an image,—judgments in which "the work seems to have all been done for consciousness."¹ There was a constant tendency toward lightening of the imaged brightness. The second series proceeded by a continuous change method. The results showed that the method hindered the employment of the image in processes of comparison, and that the individual variations were large. Although the standard was approached from two directions, yet a large amount of expectation might obscure any constant memory error. The quantitative results exhibited large mean variations.²

The third series reported by Bentley was made by the method of right and wrong cases, with special regard to the stimulation of the retina during the interval (2-60 secs.). In these tests the observer was asked to hold the image actively. The result of non-stimulation of the retina during the interval was to darken the brightness image. The amount of darkening and consequent loss of accuracy increased slowly from 2 to 60 seconds, but without the peculiar periodicity asserted by Wolfe and others.

In conclusion Dr. Bentley adds: "Simple recognition stands much nearer positive or negative identification (expressed by affirmative or negative judgments) than it does to pure memory, and the alleged act of comparison with a memory image is rather a logical formulation, suggested by the judgments 'like' and 'different,' than a psychological statement of fact. Where the image is available memory is slightly more accurate," but recognition may be sure and precise when the image plays no part.

The experiments of Wolfe³ by the method of right and wrong cases

¹ Chronoscopic measurements of such immediate judgments, in the case of recognition of tones, will be given later.

² A detailed discussion of the application of this method to the problem in audition will be given later.

³ *Phil. Stud.*, III, 1886, 534-571.

are, as regards the materials (clangs of the Appunn tonometer) and the intervals employed (mainly 2 to 60 seconds), more in accord with those of the present investigation than the experiments upon the fidelity of the visual memory image just reviewed, although in their essential purpose, since they were concerned with a functional investigation (the capacity for tonal recognition as conditioned by time interval), they are not at all closely allied to our experiments. More especially, Wolfe, as has already been mentioned, assumed that the quotient r/n (method of right and wrong cases) measured the fidelity of the memory image. This assumption depends in turn upon the hypothesis that the image is always actively present in the judgment. Thus he says (p. 556): "Gehen wir naeher auf das Verfahren beim Vergleichen zweier durch einen Zeitraum getrennten Toene ein, so ist klar, dass ohne ein Erinnerungsbild des ersten Tons eine Vergleichung ueberhaupt unmöglich ist. Dieses Erinnerungsbild ist gewissermassen der Massstab, an welchem der zweite oder Vergleichston gemessen wird." This quotation should be qualified by the following (p. 558): "Es ist aber bekanntlich nicht noetig ein bleibendes Bild im Bewusstsein zu behalten, um eine Vergleichung zu vollziehen. Selbst wenn keine bewusste Spur des ersten Tones zurueckbleibt, ist ein Urtheil oft möglich, indem der zweite Ton sofort ein Bild des ersten hervorruft."

The tone differences employed by Wolfe were 4, 8, and 12 vibrations;¹ the categories of judgment were 'same,' 'different' (higher or lower) and 'doubtful.' The results of the series with 4 vibs. D showed that there were more right cases with $D=0$ than with $D=\pm 4$ vibs. The series with 8 vibs. showed that the comparison of different tones ($D=\pm 8$) was less influenced by time-interval than was the recognition of the same tone as 'same' ($D=0$). In the series with $D=12$ vibs. there were still instances, even at four seconds interval, in which difference was recognized, but not the direction of the difference.

The discussion of the dependence of the results upon time-interval brings out the following statements. Despite many disturbing individual factors, more especially that of practice, it may be said that, in general, fidelity of the memory image for pitch decreases in such a manner that the time-interval must increase approximately in geometrical progression in order to effect equal amounts of decrease of retentiveness.² The optimal time for judgment is at 2 secs. At between 10 and 20 seconds (depending upon the observer) there is a rise in the number of right cases which may indicate, according to Wolfe, not only a cessation of the disintegration, but a positive renewal of the image. Whether the explanation be in terms of large periodic variations of apperception (attention to the image) or of the influence of

¹ In every case $D=0$ was included.

² This law is based upon the results for $D=0$.

tonal after-images,¹ the periodicity, as evinced by the curve of eight cases, remains an assured fact. The phases of clearness in the image may be assumed to be approximately constant for the same individual and the same degree of effort. The periodicity, therefore, points to a like periodicity in the attention, since clearness of memory is assumed to be dependent upon the attention.

Other general results are that $D=0$ is often judged higher than lower; higher is often judged correctly than is lower, and lower is often judged higher than higher is judged lower. These results are due to the fact that there is a tendency to estimate the memory image owing to its lessened intensity, as lower than an actually heard tone of the same pitch. Practice effects are prominent in the early stages especially in the case of unmusical subjects. Such practice effects seem to be rather restricted in their application; thus Wolfe, who was unmusical, became able to discriminate higher from lower with considerable exactness with a $D=4$ or 8 vibs., but curiously enough was then far less certain with a D of 30 or 40 vibs.

Our general criticism of the work of Wolfe can be well emphasized at this point by a quotation from the recent monograph by Martin and Mueller.² It is a source of satisfaction to find that these authors, whose general purpose, as indicated by the title of their work, is identical with our own, have made express mention of the desirability of investigations along lines which our experiments have attempted in part to cover. After referring to the experimental setting of Wolfe's work they say (pp. 230-1): "Man hat nun die Ansicht ausgesprochen, dass die Resultate derartiger Versuche ohne Weiteres geeignet seien, uns Auskunft darueber zu geben, wie die Treue der Erinnerung an den Normalton (oder sonstigen Normalreiz) im Verlaufe der Zeit abnimmt. Diese Behauptung laesst die erforderliche Vorsicht des Denkens vermissen. Aus Resultaten von Versuchen der soeben erwähnten Art kann man betreffs des Ganges, den die Treue der Erinnerung im Verlaufe der Zeit nimmt, offenbar nur dann etwas erschliessen, wenn man zuvor in wissenschaftlicher Weise etwas Sichereres ueber die Beziehung ausgemacht hat, in welcher die Resultate derartiger Versuche zu der Treue der Erinnerung stehen, also zuvor den Vorgang, welcher bei Vergleichung eines Sinnesindruckes mit einem vorausgegangenen Sinnesindrucke stattfindet, nach allen wesentlichen Seiten hin sicher aufgeklärt hat. Zur Zeit liegt aber ein ernstlicher Versuch, eine Aufklärung ueber das Wesen dieses Vorganges zu erlangen, . . . ueberhaupt nicht vor."

While it is scarcely desirable to recount the experiments of Martin and Mueller, because of the disparity between their materials (lifted weights) and tones,—a disparity which is accentuated by the introduc-

¹ "Eine periodische Tendenz zur Erneuerung einer Tonempfindung eine Zeit lang nach dem Aufhören des Reizes fortexistiert" (p. 557).

² Zur Analyse der Unterschiedsempfindlichkeit, Leipzig, 1899.

tion of an important and complicated factor, that of active movement upon the part of the observer,¹—yet it seems fitting to make specific reference here to this monograph as a noteworthy contribution to the analytic study of the judgment process. This emphasis of analysis as the ultimate problem of the psychologist is well expressed upon page 225: "Man wird mit uns darueber uebereinstimmen, dass fuer die Psychologie nicht die Untersuchung jener irgendwie definirten Unterschiedsempfindlichkeit die letzte Aufgabe ist, sondern die Untersuchung der Factoren, auf deren Wirksamkeit die Urtheile ueber die zu vergleichenden Sinneseindruecke und die Besonderheiten dieser Urtheile beruhen. Jeder jener Factoren ist, so weit es eben geht, hinsichtlich seiner Natur und Wirkungsweise und hinsichtlich seiner Abhaengigkeit von den Versuchsumstaenden zu untersuchen." Such of the detailed results of this monograph as are applicable to the sphere of audition will be discussed later.

In an article upon the "Experimental Investigation of Memory,"² Kennedy has entered a plea for the analytic study of the memory image. Thus he says (p. 484): "The general problem of memory, as it is now conceived, is that of tracing the transformations which take place in each content as it passes through time." But it is evident that Kennedy still holds to the necessity of an image in the judgment process. We quote from page 485. "In order that a certain object be remembered it is necessary . . . that some image of it be retained after it has gone." The words "some image of it" leave, perhaps, room for misinterpretation: still this author has apparently not considered it possible for a content to be recognized without the use of a memory image; nor, what is more, has he considered it possible for elementary contents, such as tones, to be recognized without the aid of a memory image of their own kind. This criticism is, I think, justified by a statement on p. 482, when, after having distinguished 'immediate' from 'mediate' (conceptual) memory, he says: "If what we are to remember is some delicate shading of color or some fine variation of pitch, it must be recollected immediately." Bentley's experiments with finely graded visual qualities³ and our own with finely graded tonal qualities show that recognitory judgments in which there is no memory image of the original stimulus are not only possible but frequent. This same objection to Kennedy's treatment arises as one reads his discussion of the fading of the image (p. 492). He urges that, until possible qualitative and quantitative (intensive, temporal, spatial) variations of the image are excluded, we

¹ The disparity extends also to many of the detailed conditions of experimentation. For example, our use of a number of irregularly placed standard stimuli makes a distinct difference between our tests and those of Martin and Mueller. Thus there is no evidence in our experiments of anything analogous to the judgments passed absolutely upon an isolated weight.

² *Psych. Rev.*, V, 1898, 477-499.

³ See especially pp. 39-40.

cannot be sure that r/n measures this fading. We prefer to say that r/n does not necessarily tell us anything at all about the condition of the image.

In view of this criticism, we fail to see how any amount of tables can furnish data for the plotting of curves of qualitative or quantitative change in the image. The only reliable guide to the transformation of the memory image in time is the careful introspection of the observer himself.¹

There remain to be mentioned the experiments of Angell and Harwood,² which are essentially similar to ours in Part I. They involve a study of the discrimination of tonometer clangs (512-1024 vibs.) under varying conditions of time-interval (1-60 secs.) with reference to the presence and function of the memory image. One-half of the judgments, however, are obtained under conditions of distraction. In their summary of results Angell and Harwood assert that "no law can be laid down in regard to a decrease in accuracy of the so-called tone-memory for intervals up to 60 seconds; the most that can be said is that there is a small and irregular falling off for some [observers] and no falling off for others." On the other hand, there is a very marked falling off in accuracy of judgment with increase of time interval for $D=0$. This latter finding is, of course, in agreement with Wolfe.

In the second paper (p. 58) Angell discusses the results gained by the use of various distractors: adding, counting metronome beats, reading backwards, listening, and clang discrimination. Their outcome may be gleaned from the following quotation: "The main conclusion to be drawn from the distraction experiments is that judgments of tone discrimination can take place, and in the majority of our experiments did take place, without conscious comparison between the present sensation and a memory image of a past sensation."

One can but regret that Angell did not pay more attention to the introspective evidence. The excuse offered, viz., that too much stress upon the introspection would have invalidated the quantitative results, seems to us to be negatived by the evidence of our own experiments. In the short intervals one can formulate the introspective report entirely by 'post mortem' examination. In the longer intervals the introspection formulates itself in verbal phrases as the test proceeds. Only rarely does this process distract from the decision at the end of the interval. The cases reported read something like this: "Image fluctuated with my breathing. Got thinking about this and lost it." As was natural, this sort of self-consciousness about the experiment occurred most often in the writer's own observations. That it is not a prominent source of error may therefore be inferred from the fact that his right cases exceed in number those of any of the other observers.

¹ For further discussion of these and cognate points in Kennedy's article, see Bentley, *op. cit.*, p. 13.

² This *Journal*, XI, Oct., 1898, 67; *ibid.*, XII, Oct., 1900, 58.

CHAPTER I.

EXPERIMENTAL.

The following experiments were conducted in the acoustic room¹ of the Cornell laboratory.

For convenience in discussion and tabulation the course of experimentation is divided into two parts, the second of which is further subdivided into four series. Each section will be treated in general as a distinct line of investigation.

PART I.

The experiments comprised under Part I are in a certain sense a repetition of one of the series published by Wolfe in 1886,² but, as we have already pointed out, our purpose is quite different; we wish to trace introspectively the nature and course of the tonal memory image,³ and to analyze the processes of judgment. For this reason our experiments are fewer in number for each observer, but especial emphasis is laid upon each individual test.

Instrument. All the tones in Part I are given by an Appunn tonometer (512-1,024 vibrations) actuated by the Appunn bellows. A weight of 4.7 kg. upon the main bellows and a weight of 1 kg. upon the lid of the tonometer give satisfactory duration and intensity.⁴ On the other hand we have found it very difficult to obtain a sufficient number of series of tones of similar clang tint.⁵ The tones finally chosen as standards are 612, 724, 832, 928 and 984 vibrations, denominated *a*, *b*, *c*, *d* and *e* respectively. The difference (D) amounts to 0 or to ± 8 vibs., so that, besides the standards, there are used the reeds giving 604, 620, 716, 732, 824, 840, 920, 928, 976, and 984 vibrations.

The choice of these tones must be made by laborious testing of the whole tonometer. It is obviously important that at least within a given group (N , $N+8$, $N-8$)

¹ This room is not intended to be sound-proof, but it offers distinct advantages for the prosecution of such studies as the present, in view of (1) its isolation by heavy walls from the other parts of the laboratory, (2) its length, which enabled the observers to sit 5 meters from the instrument when they were not distracted by the noises incident to its manipulation, (3) the adjustable hanging curtains for the elimination of echoe, and (4) the complete electrical connection with other rooms, more especially with the 'registration room,' which enabled chromometric readings to be taken without disturbance to the observers. Practically the only distraction to the experiment came from sounds external to the building. Whenever such distractions were reported the test was thrown out.

² *Op. cit.*, especially p. 542.

³ We include both the memory image proper and the memory after-image. See Fechner, *Elemente der Psychophysik*, Leipzig, 1889, 2nd ed., II, 468 ff., and Bentley, *op. cit.*, p. 15.

⁴ More especially as it is thus unnecessary to operate the bellows during the clang. A single downward thrust of the foot is made simultaneously with the 'ready' signal. This suffices to produce a steady tone of one second's duration beginning two seconds after the signal.

⁵ Cf. Stumpf and Meyer, *Zeits. f. Psych.*, XVIII, 1898, 330.

the qualitative variation of the stimulus shall predominate, and that the 'color' variation shall be minimal; otherwise there may result a judgment based upon the difference of color and not upon a true qualitative discrimination.

While the groups selected are of uniform color, they do not all furnish exactly the D (8 vibr.) desired.¹ We prefer, however, to use these reeds, since their color is uniform and their deviation from the desired D can be computed and properly distributed in the evaluation of the results.

The computation of the actual differences, *plus* and *minus*, from the five standard tones of the instrument was effected by counting the beats between the standard and the next reed above or below (*i.e.*, 4 vibr.), and then the beats between the latter and the reed supposed to give the D required (8 vibr.). In every case we made four counts of the beats, grouping by fours, and with a stop-watch took the time consumed by 56 beats. In order to avoid the irregularities of intensity which would ensue were one to actuate the reeds by the bellows for so long a time (circa 14 secs.), we applied to the tonometer a compressed air device which furnished a steady and adequate air supply at the proper pressure for over 20 seconds. The results obtained by this method showed the actual D's to be as follows:

D for <i>a</i> +, 7.678 vibr.
D " <i>a</i> -, 7.771 "
D " <i>b</i> +, 8.000 "
D " <i>b</i> -, 6.815 "
D " <i>c</i> +, 8.415 "
D " <i>c</i> -, 8.664 "
D " <i>d</i> +, 8.271 "
D " <i>d</i> -, 8.456 "
D " <i>e</i> +, 10.212 "
D " <i>e</i> -, 7.875 "

Average, $8.215 \pm .587$ vibr.

Inspection of this list shows that the average D used is 8.215 vibr.; the mean variation, 0.587 vibr.; the average *plus* D is 8.515 vibr.; the average *minus* D, 7.916 vibr. The influence of each particular D on the results will be mentioned later, when the influence of absolute pitch is discussed.

Method of Procedure and General Arrangement of Tests in Part I. During a large part of the experimentation we have found it both economical and entirely feasible to work with three observers at each sitting of one hour weekly. The observers are isolated from one another by large cardboard screens, and provided with prepared blanks upon which they record at the end of each test, their judgment, -equal (=), plus (+), minus (-), or doubtful (?);² their certainty, and detailed introspection as to the course of the image and the process of judgment.

The experimenter gives the usual 'ready' signal two seconds before the first or standard stimulus (N).

For the determination of the length of the intervals and of the tones there is fastened to the framework of the bellows immediately behind the tonometer, an upright provided with a horizontal arm from which hangs a simple pendulum. This pendulum consists merely of a thread and lead bob so adjusted as to swing in seconds. We prefer, for various reasons, a silent metronome of this sort to the ticking metronome employed by Wolfe.

¹ Stumpf and Meyer, *loc. cit.* p. 327.

² In the second half of the experimentation, doubtful tests are repeated until the observer makes satisfactory judgment, but the number and distribution of these cases are recorded.

After waiting for an interval of 2, 4, 6, 10, 15, 20, 30, 40, or 60 seconds, the experimenter gives the variable or comparison stimulus (V), which is either the same as N ($D=0$), or higher ($D=+8$), or lower ($D=-8$). No ready signal is given before V , even in the long intervals. The reasons for this are: first, that the *speaking* of a 'ready' or 'now' at the end of the interval, when the subject is attending 'with might and main' to the memory image, proves to be a distraction rather than a help; while, secondly, the slight but unavoidable noise of pumping the bellows for V , which the experimenter soon comes to produce quite uniformly and at a constant time before V , affords an entirely adequate and yet unobtrusive signal for the attention of the subject to the second tone. Both stimuli last one second, as nearly as the operator can manipulate the stops in time to the swing of the silent metronome.

The further arrangements of the tests of Part I may be summarized as follows. In each hour of experimenting, each observer is given each one of the standard tones, a , b , c , d , e , three times; once followed by $V=N$, once by $V=N+8$ vibes., once by $V=N-8$ vibes. The order is, of course, quite irregular, though the same for each observer in a given test, and care is taken that the same N is never given twice in succession; for our preliminary tests show that many observers, even after spending two or three minutes in writing their introspection, are able to identify a repeated N as identical with that of the preceding test.¹

Several weeks were given to preliminary determinations² both for the sake of practicing the observers and in order to settle upon favorable detailed conditions of procedure. After this practice period, to the results of which we shall make incidental reference, the experiments proper of Part I began.

Part I is practically subdivided in point of time into a first and a second half. In the first half the intervals (time elapsing between N and V) are taken up in the order 2, 60, 4, 40, 6, 30, 10, 20, 15; in the second half exactly the reverse order is maintained. The object of this arrangement is to distribute as evenly as possible whatever practice effects might persist after the termination of the preliminary period especially designed to familiarize the observers with the work. The results later to be discussed show that the practice curve does gradually rise during at least the first half of Part I.

It is obvious that the number of tests for each interval is

¹ The extent to which the constant use of one or a very few standards may affect the observer's judgments is well exhibited in the analyses of Martin and Müller, *op. cit.*, 43 ff.

² These include tests with 4 and 8 vibes. D at 10 and 20 secs. interval, and tests of distractors, especially reading.

doubled by the arrangement just mentioned. Accordingly each of the six observers passes 15×2 , 30 judgments upon each one of the nine intervals, so that the total number of tests represented in Part I, for all subjects and all intervals, is 1,620. The number of cases for each time-interval, 180, is relatively small as compared with the enormous number of tests which many investigators have employed when working by the method of right and wrong cases, but we do not wish to place any high degree of insistence upon the generalizations which we shall base upon purely quantitative results, since our immediate purpose is analytic. We are interested rather in the structure of the conscious processes which run their course during the time-interval and during the formation and expression, whether by word of mouth or reaction movement, of the judgment which terminates each test. We insist that, from this point of view, mere numbers are not an essential to the legitimate conduct of the psychological experiment; on the contrary, given the proper, the optimal conditions (of practice, attention, etc.), each test which includes the careful introspection of a trained observer has a right to demand for itself a hearing, to be regarded as a datum. Every such test counts for one experiment.

Subjects. The subjects in the experiments of Part I are all students in Cornell University who have had training both in general psychology and in the introspection of laboratory drill work. Since the investigation of any such problem in acoustics as the one here presented must take into account, in a rather detailed manner, the musical training of the persons concerned, it seems too vague to classify the subjects roughly as 'musical' or 'unmusical'; hence there follows a brief 'musical history' of the six subjects who participated in Part I.

1. *M.* (Miss M. F. McClure), a few piano lessons; has studied harmony; a slight acquaintance with the banjo and mandolin; sings alto or low soprano parts; carries airs very easily; generally fond of music, especially of church-organ or orchestral effects, which often incite brilliant photisms.¹ Introspection painstaking and detailed, but liable to be influenced at times by suggestion. Generally alert mentally.

2. *W.* (Mr. J. H. Wilson). Non-musical family; no lessons in singing or upon any musical instrument; very fond of music; prefers piano to any single instrument, the orchestra to the brass band; whistles and hums popular airs a great deal. Despite certain of these indications *W* must be classed as strictly unmusical, as will be shown by many features of his introspection. Unfortunately his absence during the second year of experimentation forestalled a series of subsidiary tests which had been planned to elucidate some of his peculiarities. Tendency to retain *N* by aid of articulation.² Very slow and cautious in judgment; of a distinctly phlegmatic type.

¹ For a detailed account of the photisms and allied phenomena of *M*, see this *Journal*, X, 1900, 318.

² Actual articulation or humming was, of course, excluded.

3. *S.* (Miss Claire Seymour). Unmusical, as were her parents; piano lessons when from 12 to 15 years old, including moderately difficult selections, but these were invariably acquired by committing to memory the appropriate keys; cannot recall at will more than a dozen notes of any selection however many times it has been heard. One term singing lessons; sings soprano, but only when in a loud chorus and 'carried along' by the others. Very fond of music; prefers church organ, orchestra, and male voices. Strong liking for all low tones on account of their fullness and *cool* soothing character. When a child, emotional, thrilling music,—especially that in which low tones predominated,—aroused photisms which formed quite an important mental feature for about two years. Early in the course of these experiments *S* developed visualizations which came to be uniformly present, and which at times served as a basis for judgment. These will be discussed later. *S*, as above mentioned, also associated temperatures with tones. High tones were warm and unpleasant, low tones cool and pleasant (like the bathing of hands and face in cool water). Tests of *S*'s photisms revealed nothing worthy of detailed mention. Introspection good, though occasionally restricted by a spirit of competition; *S* worried to think other observers might be getting more right cases.

4. *F.* (Mr. H. H. Foster). Distinctly musical. Training: the usual vocal instruction in public schools supplemented by about six years private lessons. Voice, bass (*E* to *e'*); uses solmization. Occasional obsessions of 'tunes in the head.' Plays violin often, piano less often. Strong tendency to fix the pitch of *N* by humming. Introspection quite good, but of a general sort, lacking finer details; constitutionally tired.

5. *L.* (Mr. R. T. Lies). Mother musical; father fond of music, but not a musician. *L* took piano and organ lessons for eight years; early taught to sing; has done a large amount of singing in choirs and choruses, for a time being organist and chorister. Voice baritone (*G* to *d'*). Cannot commit to memory easily; prefers orchestral music in general, and always harmonic music to solos of any sort. Frequent obsessions of 'tunes in the head,' mostly instrumental music; a single selection is apt to prevail for one or two days. Introspection rather scanty, stereotyped, and subject to logical bias, *e.g.*, that judgment was impossible without conscious comparison.

6. *W.* (the writer).¹ Distinctly musical; plays piano, banjo, mandolin and guitar; sings baritone; has had vocal instruction. Auditory imagery generally prominent; centrally excited tonal imagery, both vocal and instrumental, melodic and harmonic, very prevalent, especially when incited by any sort of rhythmic action, such as walking or eating. The presence of so much auditory imagery is, as might be expected, the correlate of a well developed capacity to reproduce all sorts of music at will. From continual service as experimenter as well as observer, *W* naturally obtained a very high degree of practice. There is no vestige of memory for absolute pitch.

(To translate this classification of the subjects for comparison with the German standards, we should say that *W* and *S* are hopelessly 'unmusikalisch'; *M* is also strictly speaking 'unmusikalisch,' though possibly ranking as 'wenig musikalisch.' *L*, *F*, and *W* would be 'musikalisch' in any German monograph, but they have perhaps none of them been favored with so many opportunities to listen to good music as would be implied by the connotation of the German adjective.)

Results of Part I. It follows, both from the general object and nature of these researches, as well as from the wide variation of the capacities of the observers to image tones, that the general crude results of the experiments are of relatively less importance than the more distinctly analytic data which we shall present for the most part under the heading "dependence upon the individual." Yet the individual variations must be

¹ Our thanks are due to Mr. W. B. Secor for serving as operator for *W* during Part I, and to Dr. W. C. Bagley for a similar service in Part II.

discussed in the light of the general and average results, and, moreover, despite the smaller number of cases, we believe that the numerical results are worthy of consideration as regards their relation to the Tables obtained under similar conditions by Wolfe and by Angell and Harwood.

TABLE I.* (1620 tests.)

Inter- val.	D = 0			D = + 8			D = - 8			Doubt- ful.	Total right cases.
	<i>r</i>	+	-	<i>r</i>	=	-	<i>r</i>	=	+		
2	51	6	3	39	8	13	40	8	12	0	130
4	48	6	6	43	10	7	35	15	9	1	126
6	45	6	9	42	9	9	32	20	8	0	119
10	45	7	8	39	10	10	38	17	5	1	122
15	49	6	5	42	6	12	37	14	9	0	128
20	40	14	6	38	14	8	31	17	11	1	109
30	30	20	10	37	14	9	34	18	8	0	101
40	34	9	16	31	20	8	40	11	9	2	105
60	29	12	19	32	12	14	36	14	8	4	97
Total,	371	86	82	343	103	90	323	134	79	9	1037

* *r* denotes the number of right cases, + the judgment 'higher,' - the judgment 'lower,' and = the judgment 'equal.' The nine doubtful cases are, for convenience, given in a single column. For their distribution, see below.

Table I gives the distribution of the judgments of all six observers for the tests of Part I. Attention is called to the following numerical features:

1. The right cases:

(a) *Increase of time-interval causes a general decrease in the total number of right cases. At two points, however (15 and 40 seconds), the curve is peaked.*

(b) *Both the general decrease and the two points of resurgence in the total number of right cases are traceable practically to the results for D=0 alone.*

(c) *Increase of time-interval effects a very slight but fairly uniform decrease in the right cases for D=+8.*

(d) *Increase of time-interval has practically no effect upon the number of right cases for D=-8.*

The fact that the cases for D=0 suffer most as time elapses is in accord with the results both of Wolfe and of Angell and Harwood. The rise in this curve at 15 and 40 seconds appears to corroborate strongly Wolfe's contention for a periodic renewal of the tonal memory image. We shall see how further analysis of the results bears out this hypothesis.

(e) *The total number of right cases is greatest for D=0, less for D=+8, least for D=-8.*¹ A similar result is reported by

¹ The precedence which D=+8 takes over D=-8 may possibly be

Wolfe (p. 556). We may be inclined to doubt, however, whether this fact signifies that judgments are passed with any greater accuracy and confidence when $D=0$. For, leaving introspective evidence out of account, the Table shows that, with $D=\pm 8$, the most frequent error is the judgment 'equal.' We may, therefore, suspect that there exists a general tendency to give this decision in certain conditions of doubt,—conditions in which the degree of uncertainty is not sufficient to cut off the process of judgment entirely, *i. e.*, not sufficient to be actually registered as 'doubtful.' From data to be presented later, we find that of the correct judgments of 'equal' and 'higher,' the same percentage, 76, are certain: only 66 per cent. of the correct 'lower' judgments are also certain.

2. The errors.

(a) *The errors in the order of their frequency are $=- = +$, $+ - = + = - = +$: the last four in nearly the same frequency.* We have just remarked upon the relatively great frequency of the first two errors, due to the tendency to pronounce two impressions alike when the difference between them is not clearly made out. We shall see the force of this point when we discuss the introspection of the subjects.

(b) *The frequency of the error $=-$ increases nearly uniformly with the time-interval employed. It is the smallest source of error at 2 seconds, the greatest at 60.* It is very difficult to see how this fact could be explained by Wolfe's theory² that the memory image, as it declines in intensity and clearness, is underestimated in pitch. Now it is true that our total $=+$ error is 86 as against 82 for $=-$, but the former error exhibits no gradual increase with time, although it is entirely reasonable to suppose that increase of the time-interval would emphasize gradually any such error of underestimation. The possible solution that the observers, fearing that the image was flattening as well as losing in intensity, made, as time passed, an increasingly strong effort to hold it to pitch, and thereby actually sharpened it, is shown by our tests to be the true solution in the case of some observers.

(c) *The error $+ -$ is somewhat more common than the error $- +$; neither is noticeably affected by the lapse of time.*

3. The nine doubtful cases are contributed one each from M ,

ascribed to the fact that, as is pointed out above (p. —), the average *plus D* is really greater than the average *minus D*. Wolfe assigns the precedence to underestimation of the image.

¹ That is, the judgment 'equal' is given when D is -8 , etc. When $=$ precedes, it means that $V=N$, *i. e.*, $D=0$ is given.

² *Op. cit.*, p. 556.

³ Wolfe's Table (p. 562) unfortunately does not show the distribution of errors by time-interval.

W, and *S*, two from *L*, and four from *F*, the standards being once *e*, twice *c*, and six times *d*. There are 14 doubtful cases in the second half, not indicated in Table I,¹ one from *F*, four from *L*, nine from *S*. Then the standards were three times *a*, once *b*, once *c*, six times *d*, and three times *e*.

4. *Dependence upon practice.* By comparing the results of the first and second half of the work which is represented *in toto* by Table I, it can be shown that, despite the preliminary period designed to familiarize the observers with the experiments, practice does lessen the total number of errors of each type (save that of $+ =$, which is increased in the second half of the year's experimentation). The error $+ -$ is reduced nearly one-half. The total number of right cases is increased for every interval except 20 seconds. This exception is due to extraneous conditions, being directly traceable to the fact that, on the second occasion of this test, one observer was "very hungry," another "tired, cross and sleepy." The practice effect is almost entirely confined to the unmusical observers,² thus, the total number of right cases for *M*, *W* and *S* increases from 198 in the first half to 238 in the second, *i. e.*, about 20%; whereas the total number of right cases for *F*, *L* and *Wh* increases only from 298 to 303, *i. e.*, less than 2%. There is no uniformity as regards the nature of the improvement. The chief gain during the second half is for *M*, with $D = + 8$; for *W*, with $D = 0$; for *S*, *F* and *Wh*, with $D = - 8$ (*F*, by decreasing the error $- =$, *S* and *Wh* by decreasing both the errors, $- =$ and $- +$). *L* shows no practice effect; on the contrary, he loses ground slightly for every type of *D*. We believe that in so far as regularity of quantitative results is desired, it would be advisable to train unmusical subjects by systematic coaching in *sensible* discrimination; *i. e.*, by a series of preliminary tests in which any erroneous judgment is immediately corrected.³ We did not adopt this course, because it threatened to interfere with the natural development of the judgment consciousness which it was desired to observe.

5. *Dependence upon absolute pitch.* Within the octave employed (512 to 1,024 vibs.) there is no observable dependence upon pitch. This is clear from a glance at the 'total' column of Table II. It is more difficult to assign the effect of the variations in the various values of *D* from the 8 vibs. theoretically given (see p. 417). Apparently the low value of *b*—(6.815 vibs.) does diminish the number of right cases, for in 108 trials it is correctly judged but 52 times; and, what is more

¹ See footnote p. 417.

² C. Stumpf: *Tonpsychologie*, I, 321.

³ On the effect of such a training by the method of partial knowledge, see Martin u. Müller, *op. cit.*, 195-6.

TABLE II.

(Right cases by pitches. (108 cases each.)

STANDARD.	D=0.	D=±8	D=-8.	TOTAL.
a	69	82	69	220
b	77	77	52	206
c	81	60	65	206
d	66	54	69	189 ¹
e	78	70	68	216
Average,	74.2	68.6	64.6	207.4

significant, the error — — is recorded 40 times, that of — + but 16. In other words, the uncommonly small objective value of D in this instance favors the judgment 'equal.' On the other hand, the rather large D in the case of e+ (10.212 vibr.) does not increase the number of right cases: there are even 12 more right cases with a+ (7.668 vibr.) than with e+.

6. *Dependence upon the individual,—the introspection.* The individual variations in the numerical results can be properly understood only in the light of the introspective data, for the variations in the methods of judgment and capacities for retention of different observers lead to widely divergent results under different conditions of experimentation. We shall, therefore, consider in this place not only the quantitative dependence of the results upon the individual observer, but also those questions which can be answered only by the aid of introspection. The two chief questions are: (1) what is the nature and the course of the tonal memory image, and (2) what is the nature of the judgment process?

In order to facilitate the introspection generally, to avoid stereotyping, and to direct the attention upon all the points at issue, a placard containing a full list of these points was hung before the observers, and they were requested to glance over it from time to time between the tests. We believe that the wide range of the topics thus presented accomplished the object intended without introducing the error of 'suggesting' any particular introspective verdict whatsoever. The card read as follows: Image: beginning, timbre, localization, constancy (pitch, intensity, clearness), muscular strains, associations (colors, words, etc.), attention strains. Judgment: time, certainty, terms (tonal, verbal, muscular, affective, spatial). It was, of course, not to be supposed that any large number of these points could be noted in a single introspective report, but they could all be noted in the course of three or four tests. Further, during the larger part of the experimentation, a consultation was held with each observer immediately at the close of the hour's work: his reports were carefully examined, and he was questioned upon the obscure details. Here, also, the utmost care had to be used to coach the observers without 'suggesting' the results to be found. Thus, after hinting at the possibility of a purely 'verbal' type of judgment, *M* reported eight of this sort in the next set of 15. Suggestibility of this kind must be met by counter-suggestion. Three general sources of difficulty were encountered in the early course of the investigation, but they were successfully eradicated. These were (1) a tendency to stop to introspect during the time-interval, (2) a tendency to too long after-introspection, and (3) a tendency to anticipate the relation of the coming V to N, e. g., "This will be 'plus.'"

¹ Compare the large number of doubtful cases with *d*, p. 423.

A. THE MEMORY IMAGE.

Observer *M.*

The following propositions may be laid down concerning the origin and course of the image in the case of *M*:

1. The standard (*N*) usually arouses either (*a*) photisms,¹ (*b*) strain sensations, or (*c*) associations (commonly personifications).

Examples are: (*a*) purple, dark rich blue, thin steely blue, horrid yellowish green, "darkness of the field stirred." (*b*) "Both tones seemed to be felt in brows." "*N* high and thin: strain in my head as if trying to reach it." (*c*) "Far away as if coming through a fog," "Like a tall, well-built woman with dark hair and clean-cut features."² "Made me cross, like a gruff, disagreeable old man." "Sharp like a butcher's knife" (visualized). "Extremely smooth and pleasant like a still pond in warm sunshine in summer."

2. After the cessation of *N* there is a short interval (about one second) devoid of auditory filling. The image then "emerges."

3. The image is almost invariably of the timbre of the tonometer.

The three exceptions noted are: "Image in terms of my voice supported by movement and strain in throat." "Effort to remember *N* by translating it from tone of instrument to tone of my own voice; strain in throat."³ "Image had timbre of instrument and my voice."

4. The image is localized (*a*) commonly at the back of the room, *i.e.*, at the actual source of sound; (*b*) very frequently, however, somewhere in the head; (*c*) occasionally, *N* seems to affect one ear only, and then the image is apt to be localized there.

Illustrations: "Through middle of head." "Just above eyes, inside." "In ears: thought of ears when trying hard to recall it." "*N* especially strong in right ear, and image rang in right ear all the time. The memory of *N* seemed to be all in the right side of my head." "*N* filled both ears as a cork would fill a bottle. I felt as a bottle must when the cork is put in."

5. Variation in the image.

- (*a*) Qualitative variation is but once noted.

"During the interval an 'after-image' of the tone of the previous test returned, and I got mixed up, but at *V* the real image of this test appeared." A quasi-qualitative shift is thus indicated: "Image almost lost once, but recalled by slight muscular strain and visual aid (eye feeling as if it were going down the scale and running over two or three notes as it neared, passed and returned to the right note)."

- (*b*). (1) Variation in intensity ('fluctuation') is first noted in the six-second interval; it is quite common at 10 seconds. (2) From two to four fluctuations (periodic increase and decrease of intensity) are recorded at 10 seconds, from four to seven at 20 seconds, etc. (3) At

¹ *M* was seated before a window screened by a yellowish green shade, so that the closing of the eyes for each test may have induced a positive or negative after-image which suggested these photisms. The colors observed are, however, too varied in quality and too uniform in their temporal connection with *N* to be fully explained in this way. While the color clouds rarely play any part in the judgment, other visualizations do so. At times *V* arouses a photism different from that of *N*. For a detailed investigation of *M*'s photisms, see this *Journal*, XI, 1900, 377 ff.

² In this instance *V* had the same 'feeling,' and the judgment was based upon these associations.

³ Here the judgment was made "by throat and vocal feeling."

15 seconds image-less gaps begin to be noted. (4) At 30 seconds the image may have lost so much of its intensity as to be unserviceable. (5) At 60 seconds the image is often gone beyond recall. (6) In order to keep the image at maximal intensity recourse must be had in intervals from 10 seconds up to muscular contraction (attention strains) in increasing degree.¹

"Great strains in face and neck to hold image" (15 secs.). "Held breath to hold image." "Breathing interferes and causes fluctuation, as it loosens attention to have to breathe" (30 secs.). "Could remember N better when I was not breathing; better after taking a breath than after expiring."

(c). Variation in clearness is easily confused with variation in intensity, but in the longer intervals the obscuration of the image is readily noted.

"The image fluctuated, and each time of its return seemed dimmer and dimmer."

6. Relation of the image to N and V.

(a). A good image may be constructed from a (subjectively) unsatisfactory N. "Image good and strong for such a thin and disappointing tone."

(b). The sounding of V may either (1) revive or (2) dispel the image of N.

"Image disappeared frequently and was faint, but V recalled it stronger than it was during the last half of the interval." "Image driven away by the greater loudness of V."

Observer W.

The cue to the radical difference between the nature both of the image and of the judgment of *W*, as compared with *M*, is to be found in the difference in the type of the two individuals. *W* is phlegmatic, *M* vicious; *W* is distinctly unmusical, *M* rather musical. For *W* the course and nature of the image may be summarized thus:

1. The standard (N) usually arouses (a) pleasantness or unpleasantness, or (b) an organic 'set'; much less frequently, (c) a visualization² (never photisms), and very rarely (d) miscellaneous associations (never personifications).

Examples are: (a) "Pleased at N, and said 'now it will not be so hard to distinguish the next one,'" (b) "N caused a sort of shudder, but yet it was not unpleasant," "Caused a twitch in my ear."³ (c) "Visualized the tonometer." "Saw indistinctly a big round vortex ring with waving circumference, back of me over the tonometer." (d) "Like a whistle." "Verbal association, 'clear as a marriage bell.'"

2. The image never appears at once. The image-less period is ordinarily estimated at one second, but it may be somewhat longer (five seconds), and the formulation of the image takes place so slowly that

¹ It seems very probable that the large increase of the error -- at 30, 40 and 60 seconds is due to an unconscious sharpening of the image during this active effort to hold it.

² In contrast to *M*, *W* never has a visualization with V, and has no sort of visual element in the judgment process.

³ Cf. Stumpf: *Tonpsychologie*, I, 168 f.

with the two-seconds interval there is frequently no image during this time.

A curious filling of the image-less gap is once reported: "At cessation of N, I heard the operator say 'ready,' visualized him pulling the stop, then the image appeared," *i. e.*, the image appeared only after a recapitulation of the whole experience of its production.

3. The image is always of the timbre of the tonometer.

4. The location of the image is invariably at the back of the room, and is often maintained there by the visualization of the instrument, as above mentioned.

5. Variation in the image.

(a). Qualitative variation is but once reported, and in this case there is rather uncertainty from the beginning than a shift during the period.

"Did n't get first tone well in mind. I had an argument with myself whether it was a certain tone or not, and then I got more and more certain of it as time went on. I used the image in the judgment" (which was incorrect).

(b). (1) Variation in intensity appears as soon as an image appears, *i. e.*, in the four-second interval. (2) The image may be entirely gone at the end of the six-second interval. (3) Image-less gaps of five seconds duration are reported in the 30 second interval. (4) At 40 and 60 seconds images are almost always said to be present,¹ but the greater part of them are rated as 'bad.' (5) Attention strains appear at 10 seconds, and are characteristic of all intervals longer than that.

"Held breath to keep image." "Great frowning to hold image." "Tendency to produce sound in my throat when I wanted to bring back image." "Fluctuation seemed to go about with my breathing."

(c). Two cases of shift in clearness appear to refer to an illusory bettering of the image with time.

"After a period of fluctuation, image seemed to get clearer, more distinct." (40 secs.).

6. Relation of the image to N and V.

(a). V often (1) dispels the image, but (2) more frequently it 'recalls' it.

"Second tone broke up the image." The recall is noted, *e. g.*, in the two seconds interval when no image had formed. Here the sounding of V is said to make an image of N appear. The recall is also noted very frequently in the long intervals when the image has practically disappeared in the meantime. The excellence of a 'bad' (during the interval) image which is recalled at the end of 60 seconds by the variable tone may be questioned. How shall we estimate, for example, the value of the use of the image thus described: "Had an image of the tone pretty well at first, but it fluctuated and I could hear only the high part of it, and could not tell its timbre until I heard V. Then I remembered about how N sounded, and made a judgment by comparing the two tones?" This instance bears out our previous supposition,¹ for it leads one to suppose that the auditory elements ("timbre") of the

¹ There is reason to believe, as will be shown later, that W overrates the excellence of his images in these cases, and that he may consider an image to be present when there is little or no trace of the auditory core, but perhaps simply an organic complex, strain in throat, forehead, etc.

original complex have disappeared, while the organic or strain sensations ("the high part of it") remain and are attended to as the image.

Observer S.

1. N usually arouses either (a) photisms,¹ (b) pleasantness or unpleasantness, or (c) associations (largely of visualized geometrical forms, less often personifications).

Examples are: (a) heliotrope, pale green, reddish brown, yellow line on a dark background. (b) "Low and strong and pleasant." Low tones are uniformly pleasant, high ones mostly unpleasant. (c) "Like two curved lines or rather what was contained between them; much clearer in center and growing fainter along edges." "Soothing like cool water, and more like a round ball than a line." "Image seemed like a woman, perhaps a woman's voice." "Visualized a boy blowing a 'squawker,' quite amused."²

2. There is always an interval without any auditory filling immediately after N. Its length is variously estimated from a fraction of a second to three seconds, usually at two seconds.

3. The image almost always has the timbre of the instrument.

Once it "seemed in terms of a horn" (with visualization of the brass mouth of a horn). It should be remembered that S usually carries over into the image those phenomena which are aroused at N, so that it would be, perhaps, misleading to describe the image as a merely auditory representation of the clang, *e.g.*, "the image had something spatial about it which grew larger and smaller each time the auditory part fluctuated." Similar illustrations are given later.

4. The location of the image is either (a) in space in front of the head;³ (b) somewhere within the head, or (c) very rarely, close to the head, but behind it.

(a) "Outside on a level with my forehead, having thus a location but no form." (b) "Felt in throat." "In ear and head." The following is a peculiar combination of (a) and (b) which is frequent. "Auditory image within my head, but at same time a spatial position for it outside." (c) "Back, behind left ear."

5. Variation in the image.

(a) Qualitative variation is extremely frequent with S, the variation being in every case declared a flattening in pitch.

"Image fluctuated with breathing, and flattened slightly. Did not attempt to bolster it up, simply recognized that it was too low and made allowances in the judgment." (D = -8 given; judgment 'equal.') "Pitch fluctuated a little, but I managed to bolster it up just before V came." (Judgment correct.) A quasi-qualitative varia-

¹ Unlike M, S makes these ascriptions with considerable constancy, *e.g.*, standard *a* is nearly always heliotrope; *b* is green, etc. On the other hand, S does not experience photisms outside of these tests. She does occasionally make use of them in the judgment process.

² These associations are obviously like the photisms, determined by the general organic reaction or affective result of the standard. Like the photisms, too, they exhibit rather remarkable constancy, so that, while totally unable to identify the five standards tonally, S did possess a rough knowledge of the identity of the standard by dint of these associations, thus, standard *a* is always strong, cool, round, or heliotrope. It must be added that this rough classification of the five tones did not avail in making the finer discriminations required in the tests, with the exception of the instances to be found below.

³ When the relation of V to N is based upon 'spatial' relations, V is placed with reference to this situation of the image.

tion in quality occurs once. "Image seemed alive and trying to baffle me. I became very angry and determined to get ahead of it. It danced up and down, to and fro, and I tried to make it keep the place assigned to it."

(b). (1) Fluctuation in intensity, even entailing complete disappearance of the image is reported at four seconds interval, and is characteristic of all longer intervals, though the image-less gaps are not common till the intervals of 15 seconds and longer. (2) The fluctuations may be regular, coincident with breathing, or quite irregular. (3) The support of the image by various muscular strains begins at the two-seconds interval, and is a feature of all the other periods. (But see below, 6).

"Held breath throughout interval" (two seconds). "Contraction in my throat, as if getting the pitch by singing, seem to steady the image." "Great strain around eyes to retain image." "Shook my head to keep out distracting thoughts." "Image disappears when I exhale. I sometimes 'catch' it by inhaling quickly and holding my breath."

(4) The auditory image may fluctuate independently of its visual and other concomitants, or they may vary together.

"Image spatial and auditory. Took a definite position and stayed there, though the auditory image often faded away completely." "The spatial setting of the image grew larger and smaller each time the auditory element varied."

(c). Variation in clearness is rarely noted, with the exception of obscurations of pitch, when a tendency to flat is suspected.

6. Relation of the image to V.

(a) The sounding of V (1) usually recalls the image; rarely it (2) exercises an unfavorable effect upon it.

(1) "Nearly lost image, but it came back all right after V ceased." A rather peculiar recovery, in which the reliability of the image thus gained may be doubted, is the following: "Lost image entirely after about three seconds, and did not recover it again till after V had come. All through the interval I sat relaxed, but confident that the image would come back." (30 seconds, D = -8, judgment 'higher'). (2) "Retained image, but was unable to decide between 'plus' or 'equal' because I lost the image too soon after V sounded to be able to compare."

Observer F.

1. The standard never arouses associative phenomena; there is only an occasional unpleasantness at 'reedy' clangs.

2. No mention is made of an interval after N free from an image, but the image is said to be weak just after N, then "budding out."

3. The timbre of the image is indifferently that of the tonometer or vocal. *F* says he can think tones vocally beyond the range of his voice.

4. The localization is usually in the left ear, less often within the head, occasionally over the tonometer or directly in front; it may shift during the interval.

"Vaguely somewhere on the wall." "Location in head through the interval, then, expecting V, it changed to my left ear."

5. Variation in the image.

(a) Qualitative variation is very common, and always in the form of a tendency to flat.

"Tendency to flat resisted by effort. Tendency caused by the presence of a number of lower tonal images in my mind." "Image flattened at least half an octave; it was a vocal image varying with the position of my mouth, throat, etc." "Attempted to replace the lost image by 'sliding the scale,' thought I recognized it when I came to it." "The tendency of the pitch to flat was marked by a feeling that the muscles of the head were being relaxed."

(b) A curious but frequent report was that of the presence of an "unconscious tone." This may be interpreted as an 'organic set' of some sort.¹

We shall see later that *F*'s judgments abound in 'motor' elements. The "unconscious tone" is the persistence in consciousness of the 'feel' of the place of the tone when all auditory features are lacking. "Image good for half the interval (40 secs.); then while the image seemed to last, no tone was to be found." "Image seemed to lapse before *V*, yet the sense of strain in my left ear continued, being increased at *V*." (Judgment *plus*, correct.)

(b) *F*'s images were for the most part of but "fair" strength. They tended to fluctuate irregularly, and in intervals beyond 10 seconds to lapse entirely for considerable lengths of time. They were replaced by "will power" generally, though sometimes this is analyzed into "strains in the throat," especially if the image be of vocal timbre.

(c) The image was very often vague even when of fair intensity. Clean-cut images were the exception at all intervals.

6. Relation of the image to *V*.

A lost image may return at the sound of the bellows before *V*. More often the sounding of *V* causes the image to disappear.

"Image crowded out of consciousness by turning the attention to *V*." In one series *F* contracted the habit of letting the image go into "passive attention," in order to have his "active attention" ready for the coming stimulus.

Observer L.

1. *N* causes strain and pressure sensations about the head, affective reactions or associations.

Low tones are uniformly pleasant, and are further described as big, round, filling the ear passages; high tones are uniformly unpleasant, thin, penetrating. There are two instances of visualization: "After *N* was given, a picture of the tonometer and of a musical reed came up, and I saw the sound come from a reed in the box." "*N* aroused a visual-auditory ideas of a long, lanky 'co-ed' with a voice like this stimulus, thin and 'smudgy.'" Verbal associations are: "Like the sound of the letter *L*." "Like the sound *ii* made in the upper and back part of the mouth by a female voice." The strain and pressure sensations (probably contraction of scalp and ear-adjusting muscles and perhaps changes in blood supply) are illustrated thus: "*N* produced an expansive effect within the head as if something were inside

¹ Cf. the 'organic set' of *W*, the introspection of *S*, 5 (b) 4, and the tone-less image of *Wh*.

trying to force out the forehead." "N produced a quiver of sensation around and above each ear."

2. No mention is made of an imageless gap directly after N.
3. The timbre of the image is either that of the tonometer or of *L*'s own voice, natural or falsetto.

(Standard *a* is said several times to be so low as to be imaged in terms of his natural voice, but this is obviously impossible since its frequency is 612 vibr.) Images beginning in the reed timbre usually become vocal if a strong effort is made to hold them in consciousness.

4. The image is variously localized, in the head, in both ears, just outside the ear, at the tonometer, or nowhere.

The localizations at the tonometer have some significance because the standards are placed there in strata, *a* being invariably near the floor, *e* being invariably near the ceiling, the other clangs disposed with less exactness between these two. As will be seen, this spacing plays a subsidiary part in the judgment consciousness. *L* occasionally converts intensity into distance, *i. e.*, a "waning" image seems "to wander off, far away."

5. Variation in the image.

(a). Qualitative variation is but three times mentioned, always taking the form of a tendency to flat.

(b). *L*'s images are reported to be exceptionally good.¹ Fluctuation is not reported until the 20 second interval. At 30 seconds the waning of the image is quite noticeable, but it rarely goes entirely, and can be recovered by imagining it as hummed by the voice. Even at 40 seconds the image may persist through the interval without active effort to retain it.

(c). Obscuration was not differentiated from lessened intensity.

Observer Wh.

1. At N the breath is held; associations, always auditory-verbal, are often aroused, and, with certain high notes, aural sensations, described as a sort of reflex pull, are prominent. At the sounding of the bellows for V there is a "peculiar feeling of excitement and expectation all over," and a tendency to call up the image as vividly as possible.

Examples are: standard *e*: "Verbal association, 'peep,' clear, piping, pleasant, easy to keep as an image."² Standard *a*, "A nasal, 'blowy,' clang: thought of my nose."² "Verbal, 'that's *a*.'"

2. The image "wells up" or forms itself at from $\frac{1}{2}$ to 2 seconds after the cessation of N.

3. The prevailing timbre is that of the tonometer, but it may be vocal, or part vocal and part tonometer, and it may shift during an interval.

"Kept image clear and steady by making it vocal timbre, not actually

¹ Obviously these estimates are based upon a subjective standard of excellence. It seems likely, for instance, that *L* overestimates, while *F* underestimates, the worth of his images.

² It is of interest to note that this preference for *e* and distaste for *a* are exactly opposite to the attitude of *L*.

vocalizing, but hearing a purely centrally-excited humming or falsetto tone." "Image usually tonometer timbre now, but it has a number of vocal associations tacked on to it, *e.g.*, contractions of the pharynx, alterations of expiration, localization in the throat, though all these are frequently only imaged, not carried out peripherally." "Started vocal; changed it arbitrarily to tonometer." "Images of a clear, penetrating timbre are easily held."

4. The image is usually localized at the tonometer; it may also be in the head, throat, ear or nowhere. By attention it may be placed almost anywhere. Often its location suddenly shifts when *V* sounds.

"Image was at the tonometer, held there by purposed visualization of the instrument.¹ At *V*, or at the sound of the bellows for *V*, it shifted to my throat, and *V* placed itself outside my head higher up. *V* seems to belong outside because it is peripherally excited, and higher because it is higher tonally.

5. Variation of the image.

(a). Qualitative. *Wh* exhibits two peculiar phenomena of a qualitative nature, the feeling of a "tone-less" image, and the presence of two or more rival tonal images during the interval. The latter occurrence is extremely frequent, almost the rule in the long intervals. The general tendency of the image is to sharp rather than flat.²

"Several times during the interval, I thought I had the image, but there was only an 'organic tone,' throat contraction and an altered breathing, etc., without any auditory elements. I kept thinking something which swelled up and gradually died out at regular intervals but it was not tonal." "At about six seconds a lower tone, separated from my image by quite an interval, appeared and bothered me." "Several other pitches presented themselves as candidates. I got disgusted, dropped them all, and made the decision without any image." "During interval, I heard repeated several times a little melody of three notes. Two came with each inspiration, and one, longest and strongest, the image proper, with each expiration. The last was coincident with *V*, so judged 'equal' easily." "Lost my image, so ran up and down the scale: a certain quality seemed most familiar, so I imagined that, and made judgment easily" (and correctly).³ "Two images after about the 4th second, the new one was higher and seemed to be suggested by an apparent rise in *N* as it was shut off."⁴

(b) Intensive. As reported, *Wh*'s images rank in intensity between those of *F* and *L*. At two seconds the image is faint,⁵ not having had

¹Reference to the tonometer is a very frequent device with *Wh* to artificially "force" the image, *e.g.*, "Got twice a very strong, hallucinatory image by thinking of blowing the tonometer very forcibly."

²This tendency is found in such introspective verdicts, as, "V way below my image." It is further amply borne out by the numerical tables which indicate that in the intervals of 30, 40, and 60 seconds, *Wh* has a strong tendency to err in the direction which presupposes a sharpening of the image, provided the image is used in the judgment. In conjunction with *F*'s tendency to flat the image, as shown both by his introspection and his numerical results, this individual difference shows the futility of such generalizations as that of Wolfe when he takes it for granted that the image, because of its weakness, will be constantly underestimated in pitch. We do not wish to imply, however, that the qualitative status of the image necessarily influences the decision at all. *Wh*, for example, often gave such reports as, "V was way below my image, yet I felt compelled to judge 'equal' on account of some feeling of familiarity." (Correct.)

³The usefulness of an image thus secured in making a discrimination of 8 vibrations after an interval of 40 seconds is clearly questionable.

⁴Compare a similar effect with the bottle tones later mentioned. The rise, at least here, is subjective, as subsequent tests demonstrated.

⁵*Wh* suggests that the seeming faintness, which amounts sometimes to absence of the image, may be due to the fact that since, in this interval, it is so near *N* and *V*, the image suffers from contrast.

time to fully "mature." At four seconds it is steady after it has matured, and does not need to be actively forced. At six seconds general attention strains appear, composed of sensations set up by contraction of the pharynx, of the arms, and by alterations in breathing which is irregular and shallow. There may be a gap without image.

"Heard image sound, stop, start, etc., twice, an exact repetition of the sounding of N."

No image persists through 10 seconds without fluctuation. Usually there are either two or three waves or periods of intensity, the image being strengthened at each expiration.¹ Keen attention to N is a prerequisite for a good image for this period. At 30 seconds, the image is precarious, it suffers from the slightest distraction, central or peripheral, demands urgent attention, is subject to lapses and to qualitative obscuration by the appearance of other pitches. At 40 seconds, it is always unreliable at the end, and usually gone entirely. To hold it in fair intensity for 60 seconds is almost impossible; any relaxation kills it.

(b). Clearness. Variations in clearness are indicated closely parallel to those in intensity. The qualitative uncertainty occasioned by the presence of secondary pitches may also be regarded as a loss in clearness. Clearness may be recovered when lost, as well as intensity; *e.g.*:

"Slight uncertainty of pitch for a while, then it cleared up" (15 secs.). "Got clearer toward the end of the interval" (6 secs.).

Several times artificial devices are used to enhance the clearness, *e.g.*:

"At about the tenth second, I tried to see if I had the image clearly by imaging a lower tone as if on the tonometer, and seeing if I could tell the difference. I wanted to make sure that the image had some determinateness."

6. Relation of the image to N. A good image depends on keen attention to N. If for any reason, N is somewhat faint, the image may yet be steady and clear, though faint.

B. THE PROCESS OF JUDGMENT.

The analysis of the judgment consciousness is a matter of some difficulty. The reason is to be found in (1) its complexity, (2) its rapidity, and (3) in the close combination of the essential with the many unessential features of the process.

Observer M.

The following statements indicate the nature of M's judgments.

1. Terms: The judgments may, for convenience sake, be grouped under a number of headings, although it is to be remembered that no hard and fast lines can be drawn and that exact rubrication is not always possible.

¹This is very commonly reported, *e.g.* "Pharyngeal contractions at each expiration seem to be the natural sort of innervation by which to attend to tones." Later, however, *Wh* says "it is perhaps partly accidental because, by taking thought I can make the intensity increase at each inspiration, and, furthermore, the image often fluctuates independently of breathing." Cf. the "innere Singen," mentioned by Stumpf, *op. cit.*, I, 176-7.

(a). Exclusively tonal. This type is very rare, and found in '*equal*' judgments only.

(b). Auditory-visual, more frequent.

"V seemed to fill the place occupied by N and to be a repetition 'out loud' of my image." This type is closely allied to

(c). Auditory-visual-motor, in which the 'placing' is more emphatic.

"Image just appearing when V came and perfected it, for they 'melded' ¹ perfectly." "Seems to be an auditory placing together of the tones as one would place two sticks side by side." "V higher in auditory scale; feeling of actually placing it there."

(d). Visual-motor, in which the auditory element is practically negligible. "I placed the notes visually in a ladder scale."²

"V fell in place visually just below N." "I could *see* the comparison. Judgment based on this visual feeling, coupled with strain in the forehead." "N was high up in my visual scale (ladder). V took its place below N at once. Judgment was visual and immediate. Later came the auditory verbal formulation, '*lower*.'"

(e). Purely visual, rare.

"N caused a peculiar feeling as if something dark were pressing on my eyes; at the sounding of V, it was lifted, and a slightly blue, bright gray appeared. Knew at once that it was '*plus*.'" "Very light blue color with N. Judgment made by comparing this color with what might be the color of V."

(f). Auditory-motor, rare.

"Judgment made by direct comparison of tones, aided by muscular strain in throat."

(g). Purely motor (strain sensations, usually of eye or scalp muscles).

"Although I saw nothing, I was comparing visually." "Eyes dropped on N, raised on V. Made an easy and certain judgment of '*plus*.'" "Immediate judgment, for at V there was a slight movement of the eyes as though placing one object below another."

(h). Affective (always with other elements).

"Feeling of 'melding' of tones. Pleasant feeling as though something were satisfied."

(2). Dependence of judgment upon the image.

a) The presence of a satisfactory image usually favors the decision, but (b) with the longer intervals, 'certain' judgments are made when no image is present, and, on the other hand, (c) the presence of a good image does not guarantee a satisfactory judgment.

Illustrations are: "Judgment not immediate, but almost so. Image entirely gone [60 secs.], yet V seemed certainly lower" (correct). "Best image I have had yet (20 secs. interval), but V weakened and destroyed it. Judgment immediate, but uncertain [and wrong]; reconsideration did not make it certain."

3. Speed of judgment.

(a). The majority of M's judgments are immediate, *i. e.*, made with-

¹A word coined by M to express the feeling of '*equal*' judgments. It is, she says, not exactly either 'welded' or 'melded,' but between the two.

²This is an early and a very prevalent type. It is found, excepting in a few cases, with judgments of '*higher*' or '*lower*' only.

out conscious comparison (decided always before V has ceased sounding, one second). The image may be present or not. The greater part or 73% of the immediate judgments are correct. This type prevails when $D=0$, 68% of the judgments then being immediate.¹

(b). (1) Conscious comparison, *i.e.*, the voluntary relating of the image of N to the image of V after V ceases, is less frequent on the whole, but it is more frequent when $D=\pm 8$, 57% of these tests being judged by comparison. (2) Judgments involving comparison are oftener wrong than right. (3) Comparison is a clumsy device, used in cases of doubt.

"V different from N, but could n't tell the direction, so I finally decided by trying to recall both tones."

(c). Judgments in which the decision is reversed or debated are not uncommon. There is an immediate judgment, then indecision followed by laborious comparison, and usually by a change of judgment. It is especially interesting to note that in three-fourths of these cases the first 'immediate' reaction is correct.

4. Certainty of judgment.² In 269 cases *M* reports 195 'certain' judgments. Of these the majority (127) are correct. On the other hand, of the 74 'uncertain' judgments, the majority (46) are wrong. The certain judgments are distributed thus: when $D=0$, 72; when $D=+8$, 59; when $D=-8$, 64.

5. Judgments of difference without knowledge of the direction of the difference are quite common.³ They are, for the most part, recorded only when V really differed from N. The judgment 'different' seems to be more easily and more quickly aroused than the judgment 'higher' or that of 'lower.'

"My judgment of difference was immediate, but that of the direction was later and quite slow."

Observer *W*.

I. Terms.

(a). Exclusively tonal. (1) Qualitative. This is the typical form of judgment for *W*. It is usually characterized by deliberate comparison of memory images of both tones.

"When V came I listened to it, then heard the first (N) again, and then judged the second lower by comparing the two images." "Seemed to identify V with N auditorily." "Judged in tones and then translated into words." This form occurs also when D differs from N, in contrast with the case of *M*. "V seemed to run in on image, and there was a change."

(2). Auditory judgments are occasionally based upon the intensity instead of the quality of V.

For example: at 60 seconds standard *e* was given both as N and V. *W*'s judgment was 'lower.' "No image left, but when V came it

¹ These facts correlate well with the further fact that for *M* there are more right cases when $D=0$ than when $D=\pm 8$.

² For further discussion see pp. 445-6.

³ Reported also by Wolfe and by Angell and Harwood and by Freyer (Stumpf, *op. cit.*, I, 313).

just appeared to me that it was lower than the first by feeling more intense."¹

(3). *W*'s unmusicalness is well exemplified by the fact that he is often unable to differentiate quality from timbre, and that, accordingly, large numbers of decisions are based upon what he terms a difference in timbre.

We have already mentioned that the reeds used were carefully selected to avoid any such differences, but convincing proof of the subjective nature of this alleged distinction is afforded by the fact that in the cases when $D=0$, *W* frequently reports "2nd more reedy," and again in the repetition of the same standard and variable (*e.g.*, a and $a-8$), the report is once, "first clearer," and again, "first more reedy." It is likewise impossible to see any uniform connection between *W*'s estimate of the timbre and his decision. To be sure, he says once "2nd had that reedy quality more and, hence, is lower," but on the same day he makes several judgments of "higher" when the "second is more reedy."

(b). Auditory-visual, but (unlike *M*'s) with the visual features subordinate and inessential.

"Almost always (?) when I judge I visualize the tonometer and bellows." "Deliberately compared, and saw keys of a piano."

(c). *W* has no visual-motor or purely visual judgments.

(d). Auditory-motor, rare.

"I know how the sounds sound exactly (?), but just can't say whether it should be 'plus' or 'minus.' I tried to determine by articulating."

(e). Motor.

Both *N* and *V* often occasioned a "twitch in the ear." *W* thinks these sometimes influence his judgment; if the second twitch were stronger he would certainly say "higher."

A sort of organic basis of judgment is once or twice found.

"At *N* felt a nervous feeling go through my whole body. When *V* came I said it did not feel at all like the first. I think I compared the feelings."

(f). Affective.

A single doubtful use of the affective reaction as a basis for judgment is this. "*N* caused a twitch in my ear. *V* sounded better and softer to the ear, so I at once judged 'lower.'" This instance may be, perhaps, reduced largely to intensity. Like *M*, *W* is most pleased by 'certain' judgments, but, since most of his certain judgments are based upon a process of comparison, he does not report that pleasure in quick, flash-like judgments which we have noted in the case of *M*.

2. Dependence of the judgment upon the image.

The doubtfulness of *W*'s estimate of his images makes this point difficult, but it is safe to say that (a) judgments may be formed after the image-less two second interval, though possibly the image does get formulated in the judgment, and that (b) judgments made by sudden impression, without the presence of any image, are quite rare.

We have already seen that the auditory excellence of the image

¹ It is probable that this error of mistaking the intensity of *V*, as compared with the remembered intensity of *N*, as an index of "lower" accounts for the peculiar prevalence of this judgment in the longer intervals, *e.g.*, 10 out of 15 cases at one sitting. Here again is evidence against Wolfe's appeal to the lessened intensity of the image as a source of the error = \dagger . (Note our previous discussion, p. -.)

reported is probably questionable. The following is an instance: "Fell to noticing a twitch in my throat, and thus lost the image, and then the image got lost in a song, but at the judgment I had both tones (N and V) in my head to compare." (60 secs.)

3. Speed of judgment. It is difficult to classify *W*'s judgments on the basis of speed.

(a). When $D = \pm 8$, it is usual to have a quick judgment of difference, and a slow one of direction.

(b). Really immediate, flash-like judgments are very rare.

Even in his so-called 'quick' judgments *W* compares the two images. Thus *W* differs from *M* in every point under this rubric.

(c) Outside of the hesitancy in assigning the direction of a difference, just mentioned, the chief debated judgments waver between 'equal' and 'lower.'

An example of a less frequent class is the following: "I said quickly 'this is plus or equal,' and then reasoned that saying *equal* was only because they seemed almost *equal*, but that V was really a little *higher*. This all quick. Had images of both to compare."

4. Certainty of judgment. *W* has less 'assurance'¹ than *M*, yet the majority of his judgments are 'certain.' Contrary to *M*, his assurance is greater when $D = \pm 8$ than when $D = 0$. The majority (59%) of the certain judgments are correct; the majority (58%) of the uncertain are wrong. Uncertainty increased markedly after the 15 seconds interval.

5. Judgments of difference without knowledge of its direction are extremely common when D is 8, even with the short intervals.

Instances have already been noted. *W* suggests that this may be due in part to a confusion of the two images while they are being compared. "Compared the tones, knew they were different, but had trouble in deciding which was high and which low."

Observer S.

1. Terms.

(a). Tonal, very frequent, especially in long intervals, with all forms of D .

"Convinced myself of the 'plusness' of V because it did not seem to harmonize with N." "Thought of scales as I had heard them sung, and this seemed like the interval c-b as one sings down the scale, and so I judged V *lower*" ($D=0$). "Equal judgments usually seem to chord or harmonize tonally."

(b). Auditory-visual, infrequent.

(c). Visual, not common.

"N caused pale bluish-green, and V was the same. Recognized equality by color." "Heliotrope patches all through image and interval. These were reinforced by V, so said 'equal.'" By the addition of the place relations this type merges into (d).

(d). Visual-motor.

"N had a certain definite length, breadth and thickness, and V seemed to fit over it." "Image seemed like a horizontal line, and V

¹ Assurance is measured by the number of times 'certain' is recorded, without heed to the correctness of the decisions.

was placed in the same position. Made the judgment in these terms, though uncertain because the auditory relations did not seem to correspond with these." (Judgment correct.)

(e). Auditory-motor.

"V placed itself on N, and I made the judgment in these terms, though the auditory elements also entered in."

(f). Motor.

"I had a certain position for N, and I seemed to put it there, and felt it would stay there all through the interval. When V came it took a higher position without any effort on my part."

(g). Affective elements appear often in the judgment process, but they do not constitute an essential part. *S* has pleasure in 'certain' and generally in 'equal' judgments.

2. Dependence of judgment upon the image.

(a). The large majority of *S*'s judgments make use of the image either in its auditory form, or, less often, in its visual setting (place, lines, color, etc.). Conversely, the lack of the tonal image works the most damage.¹

"Held spatial position of the image, but lost its auditory portion. When V came I could make no judgment because it was auditory, while my image was only spatial."

(b). Only a single instance of a sudden imageless judgment is reported, and that felt uncertain.

"Judgment an impression, not a decision." On the other hand,

(c). Occasionally a good image may be present without insuring a decision.

"Good attention, and good image, but I simply could not make up my mind between 'equal' or 'different.'"

3. Speed of judgment.

It is almost useless to speak here of the speed of *S*'s judgments, for unfortunately only 109 out of 270 tests contain the introspective indications required. Of those reported, however, it may be said that (a) slightly more judgments are compared than immediate, and (b) the majority of the immediate judgments are correct while the majority of the slower, compared, are incorrect. (c) A sort of comparison coupled with the method of exclusion is a curious feature of *S*'s judgments. With $D = -8$ it is so frequent as to be the rule rather than the exception. Almost always the result is correct.

"Compared the images several times. Decided they were not *equal*, and V was not *higher*, hence it must be *lower*." "Always have trouble with the 'minus' judgments, and have to argue them out."

(d). Another very common and peculiar feature with *S* is the comparison of the feeling of the present relation of N and V with that of some just previous test or tests. This is a part of the many schemes (singing descending scale, visualizing piano keys and scale, etc.) used to keep the categories 'equal,' 'higher,' 'lower' distinct, for owing to her unmusical nature *S* has apparently no deeply ingrained 'feel' for these relations.

¹ *S*'s quantitative results, which are extremely poor, are to be laid to poor sensible discrimination rather than to a poor tonal memory. Cf. Stumpf, *op. cit.*, I, 289.

Examples are: "After recognizing a difference, I said '*minus*,' influenced by my two previous judgments of *minus*." "Judgment slow; thought first that the two were *equal*. Then thought of test 2 (third before this), and compared the two impressions (of 2 and 5). Then decided that *V* was *higher*." "This combination felt different from the preceding test ('*equal*'), and felt high rather than low, hence '*plus*'" (correct).

4. Certainty of judgment. (a) The amount of certainty was recorded in but 232 of the 270 tests. Slightly more than half (128) are 'certain.' The majority of these (76) are correct. The objective accuracy of the 'uncertain' judgments differs from the results of the other observers in that more, though but very slightly more, are correct than incorrect (53 correct out of 104 uncertain).

If we ask the reason for this, it is easily found in the method of making '*minus*' judgments just mentioned. The figures show that when $D = -8$, the majority of the 'certain' judgments are wrong, and the majority of the uncertain judgments are right. *S* makes many of her '*minus*' judgments by the method of argument and exclusion; they are troublesome, hence uncertain, but they are oftener right than wrong. Omitting these peculiarly constructed '*minus*' decisions, the conclusions found for the other observers hold good for *S*.

(b) An interesting feature with this subject is the fact that writing down the judgment, or repeating the tonal interval several times, often brings on a feeling of certainty which was not present when the judgment was made.

"Thought this interval (tonal) did not seem exactly like the previous one ($D = +8$, judgment '*minus*'). Reflected that this might, however, be right, my previous judgment wrong, so gave the judgment '*minus*'." (D was 0.) After writing it down, I felt very positive that I was right."

5. As with the other observers, judgments of difference are more quickly and more easily made than judgments of higher or lower. This occurs only when D is really ± 8 vibs. With *S* it may even be said that judgments of higher or lower are, as a rule, made only after a preliminary assertion of difference.

6. An isolated instance which illustrates the automatic nature of the judgment consciousness as it is created by the conditions of experimentation is afforded by *S* who, while attending to the image during a long interval, mechanically passed a judgment of '*higher*' when a street car bell rang outside the building, very much to her surprise and amusement.

Observer F.

1. Terms. *F*'s judgments are of two types, an auditory and a motor, with or without an auditory fringe.

(a). Auditory. This type is always found with judgments of equality. *V* is felt to be simply a re-enforcement of the auditory image. Auditory-verbal phrases such as "That's higher" may be present in judgments of difference, but they are secondary.

(b). A single instance of a visual component in the judgment consciousness is the following:

"Saw image as a line in the space before me, and then V as another line shooting just below it whereupon the old one faded from view. At the same time a sense of relieved muscular strain was noted." We are inclined to class this under the motor type and consider the visual element as the result of some suggestion from the other subjects of visual proclivities.

(c). The auditory-motor or motor type is meant to embrace judgments which are characterized by pressure, strain, and organic sensations of any sort which combine to place the tones spatially in a vague manner. This type is always found with judgments of higher or lower.

Examples are: "Judgment conditioned by a loosening of the muscles (scalp?) on the left side of the head." "Based upon a further tightening of the muscles of the ear already 'set' for the pitch of N." "Recognition a moving of the head up and forward." "My 'set of the ear' means not only strain sensations, but also, apparently, an expectation of a certain sort of pressure. A low note gives a broad dull pressure, a high one a stronger pressure. In a '*plus*' judgment I feel this change." "Judgment accompanied by a pressure upward in the head."

2. Dependence of the judgment upon the image. *F* exhibits an irregularity difficult to explain, for

(a) many judgments are passed easily without the presence of an auditory image, but

(b) often the absence of an image precludes any attempt at a decision. It may be that in the latter case whatever serves to represent the image in (a) is also gone.

3. Speed of judgment.

(a). Of the cases reported the majority are immediate, *i. e.*, passed within one second and without comparison. There are 202 such instances and 164, 82%, are correct. This type is most common when $D=+8$.

(b). Deliberative judgments are most frequent when $D=0$. Only 23 out of 40, or 57%, are correct. *F* contributes one peculiar case of a very slow decision in which there were nevertheless, no image and no comparison.

(c). There is but one instance of a debated judgment.

"At first it seemed *equal*, and then suddenly recognized it as *lower*, and was certain."

4. Certainty of judgment. In 266 cases *F* reports 171 'certain.' Of these 145 were correct. 55 of the 95 uncertain cases were wrong. Certainty was greatest when $D=+8$, least when $D=-8$. Usually *F* had three or four uncertain tests in a group, perhaps indicative of a temporary lapse of attention or of a temporary loss of confidence.

In one test "V was higher, hence judgment instantaneous, but it was so much higher that I knew image must have flattened, so I was uncertain."

5. *F* never confuses the direction of a difference.

Observer L.

1. Terms. *L*'s judgments seem, perhaps as a consequence of his ex-

cellent images, to be substantially all of the auditory type. When other elements are present they are subsidiary.

(a). Auditory. These judgments may be quick, but they involve the presence of the image and a rapid observation of the relation of V to this image as tonal sensations. In the few cases reported in which the image was lacking just before V, L thinks that it must have "popped back" and thus entered the judgment process. Whether this is not the result of the logical bias in favor of comparison which we have already noted in L is very doubtful.

(b). Auditory-visual type, but once reported.

"Process of judgment involved a visualization of a piano keyboard. Tones were seen to be apart, V above N."

(c). Auditory-cutaneous (?). L often mentions that the sensation around the ears, which is external and quite pronounced, starts at N and gradually fades during the interval. If V=N, this sensation is picked up or re-enforced in a noticeable manner; if $V=N \pm 8$ vibs. this sensation is not intensified. At any rate it is a secondary phenomenon.

(d). Auditory-motor.

"There was a distinct representation of V being vertically above N." "Image localized just outside the ear. Thought, if V is the same, it must come right to the same locality, and it did."

(e). Affective elements appear only as a pleasantness at judgments of equality, especially if the tones were also low.

This pleasantness may account for the fact that L makes the error 'equal' for 'plus' 17 times as against the error 'minus' for 'plus' 4 times, and the error 'equal' for 'minus' 49 times as against the error 'plus' for 'minus' 10 times.

2. Dependence of the judgment upon the image. As already hinted, L's judgments are unique in the constant use of the auditory image.

An interesting feature in this connection is afforded by his description of the relation of the judgment and the image in fairly long intervals. Following N the image of the clang itself ensues, first "wide" (strong), then "narrowing to a point." "When the point is almost reached I renew the image, so that it is wide again, by executing some imaginary humming for a brief time. If N comes when the image is 'wide,' judgment is easy, otherwise more difficult."¹

3. Speed of judgment. Data sufficient for numerical results are lacking. At first L insisted upon deliberate comparison. Later he reported many rapid judgments, always auditory and with the presence of the image; the deliberative judgments² being exhibited only

¹ If we add to this description the further fact that such a process of renewal takes place according to L about three times in a 40 or 60 second interval, we have some facts not unlike Wolfe's phenomenon of periodicity. The likeness is enhanced by the fact that L's curve for right cases shows peaks at 15 and, more noticeably, at 40 seconds. It seems plausible, then, that L represents a type of observer similar to those of Wolfe, using in the judgment an image which, either voluntarily or involuntarily, is renewed at intervals of time approximately constant for the same individual.

² The distinction is this: in the rapid judgment the image is present. As soon as V sounds it is known to be equal, higher or lower than the image. In the slow, deliberative judgments, exhibiting true comparison, no decision can be reached until, after V has ceased, the attention is turned alternately to the image of N and to the image of V. The first type is the more common with L, and, save when $D=-8$, the more accurate. It is never uncertain.

in difficult tests, whether because *V* and *N* seemed only very slightly different, or because some distraction had weakened the image.

(b). Debated judgments are not met with.

4. No quantitative statement of *L*'s certainty is possible owing to the lack of introspective evidence. One can merely say that his assurance was far greater than his correctness.

5. *L* never confused the direction of a difference.

Observer Wh.

1. Type of judgment. *Wh*'s judgments are nearly identical in type with those of *F*, being almost uniformly auditory, not in the sense that the variable tone is compared with the image of the standard, but in the sense that it is this *tone* *V* which is judged to be 'equal,' 'higher' or 'lower,' and not a color, or pressure or other sensation. But, it must be added that the position of *V* as an auditory sensation is for the most part determined by other than auditory elements, viz.: by those sensations which we have, for convenience sake, grouped under the term 'motor.'

(a). Purely auditory. Notably in cases of equality, *V* simply reinforces the auditory image. Rarely the auditory judgment is verbal.

"Judgment took one second, not to compare, only did n't feel sure till I had put the decision into words and said '*lower*.'"

(b). Auditory-motor. Judgments of either 'higher' or 'lower' almost invariably are based upon some more or less distinct spatial relation between the image and *V*, or upon an alteration of strain at *V* without any reference to either the pitch or 'place' of the image.

" '*Minus*' because of a distinct feeling of depression about my arms and chest." "Some sort of drop in my throat as well as a different external spacing for image and *V*. This spatial difference is certainly in consciousness before the fiat of judgment itself, whether it be its essential basis or not." "I hold the image steady at a certain point in my throat or externally, and in judgments of '*minus*' or '*plus*,' *V* comes in above or below this point." "*V* came into same space in my head, so judged '*equal*.' This is unusual; there is not apt to be any spatial reference in the equal cases." "*V* considerably separated from image, further from me and perhaps to the right; a sort of 'here versus there' feeling."

(c). Auditory-visual-motor. There are two rather hazy instances of visual components.

"*V* lower vertically, in a different place visually." "*V* farther to right, perhaps with a vague association of a piano keyboard."

(d). Unanalyzable. Certain judgments, especially at the end of long intervals are made, as *Wh* puts it, "by catching at straws;" such decisions are difficult of analysis.

"Judgment slow. Thought it was '*equal*,' but at the last moment I had an irresistible impulse to put down '*minus*,' though I don't see why this impulse came." (Correct judgment.) "The feel of familiarity which touches off the judgment of equality seems to resist further analysis."

2. Dependence upon the image. *Wh*'s introspection is uniform in

showing that keen attention to N is of importance to the decision, but that the condition of the image when V sounds is of secondary significance.

"Good image, but judgment took about 4 seconds, and was uncertain" (and wrong). "No image at all at end, but judgment very rapid and certain." "V was far below my image, yet I felt impelled to judge 'equal' on account of some feeling of sameness not further analyzable." "Image split up into two, and I gave up trying to hold either one. V had feeling of *belowness*, no shadow of a comparison."

3. Speed of judgment. *Wh* found it very easy to subdivide the speed of judgment into several categories,—instantaneous, very quick, slow, deliberate comparison. The rate termed "slow" belongs in classification to the 'immediate' group, for it implies a time of about one second, and, what is of importance, does not imply any trace of comparison of images.

(a). Thus grouped, *Wh* has 220 immediate judgments, of which 194, 88%, are correct. Immediate decisions are slightly more common when $D = -8$.

(b). The 'compared' judgments number but 35, of which but 24, or 65%, are correct.¹

(c). Judgments in which the decision is reversed or debated are occasionally found. These are almost always cases in which there is an instantaneous judgment for 'minus' or 'plus,' followed by a doubt and a fear that it might be 'equal' because the difference is so small.²

4. Certainty of judgment. *Wh* had 200 certain, 70 uncertain judgments. The correlation of assurance and correctness is shown clearly, since 182 of the certain but only 45 of the uncertain cases are correct. There is greatest certainty when $D = +8$.

5. Judgments of difference without knowledge of its direction are infrequently reported, perhaps a half dozen in all.

In three of these cases the difference was finally judged correctly, e.g. "Knew difference at once, but had to compare tones to get its direction." "Judgment certain and quick, but it seems as if I noted the difference before its direction. Very vague spatial *belowness*."

C. SUMMARY OF THE INTROSPECTION.

In the light of the fairly bewildering individual variations just recorded, one can but hesitate to generalize. The following statements are put forth, therefore, only tentatively, not even in the hope of covering all the main points of importance, but in the endeavor to present a sketchy outline of the course of the image and of the nature of the judgment process.

¹ We should hardly expect *Wh* with his extensive practice to show a predominance of wrong cases with deliberated judgment as do some of the observers.

² This seems an exceedingly apt illustration of the use of the image in the judgment. The decision for 'minus' or 'plus' is based upon a 'feel,' a sudden relaxation of some muscles or a 'motor' spacing. There is in that moment no thought of the tonal relations of the variable to the standard pitch; only in the next pulse of consciousness does the auditory relation come into the focus of attention, if it comes at all, and only then does the doubt of the decision appear. The first decision is the one commonly recorded, and nine times in ten it is correct.

(1) The tonometer clang arouses a wide-spread reaction, adjustments of the organs of hearing, pleasantness or unpleasantness, visual, verbal and other associations, often of considerable vividness and detail, and organic 'sets' of various kinds. These supplementing processes help to give the auditory image an individuality; their nature, prevalence and distinctness depend upon the constitutional tendencies of the observer.

(2) Not until a noticeable interval after the stimulus does the auditory image appear. It then swells suddenly out into its maximal clearness and intensity, in the timbre of the stimulus, localized at the instrument, and usually devoid at first of all those adjuncts just mentioned.

(3) Left by itself it then decreases in intensity and clearness. To offset this, the observer has recourse to various memorial aids; he visualizes the instrument, contracts his throat with incipient humming (changing the timbre and localization of the image), and exhibits all those muscular phenomena which characterize active attention, with emphasis also upon certain similar phenomena (notably in connection with respiration) which are felt to be especially effective for attention to an auditory image. Despite these efforts, attention must wane, and with attention, the image. It suffers most noticeably in intensity, less in clearness, and least in quality (here by tending to flat or by getting mixed with other auditory images). Some observers exhibit a long inaccurate retention, others a shorter but more accurate retention.¹

(4) As a rule the image, under the conditions of our tests, is of little avail for discrimination at the expiration of 30 seconds, while it is very often entirely gone at 60 seconds.² This decline and loss of the auditory image does not necessarily imply a corresponding decline and loss of the various supplementary features which played a part in the identification of N

¹C. Stumpf: *op. cit.*, I, 77.

²This is quite contrary to the conclusion of W. v. Tschisch, who says (*Dritter Intern. Cong. f. Psych.*, Munich, 1897, p. 108): "Ebenso ist es eine allgemein bekannte Thatsache, dass wir die Qualität von Gehörs wahrnehmungen einige Minuten hindurch mit aller Schärfe behalten, während gute Musiker in dieser Beziehung über ein erstaunliches Gedächtniss verfügen." Stumpf's violin test (*op. cit.*, 230-1) is entirely off the point so far as it pretends to indicate the reliability of the tonal memory image. The tuning of a stringed instrument, according to our experience, may be effected with some accuracy, after any amount of elapsed time, by the aid of certain secondary criteria,—tension of the string, sympathetic resonance of the other strings, etc. Compare Bentley's results already cited, to the effect that brightness images could be recalled better at the end of five minutes than at the end of one minute.

and which may have persisted in the background, now to become themselves the objects of attention.

(5) When the comparison stimulus sounds, it is, under favorable conditions, immediately known to be 'equal,' 'high' or 'low'; this whether or not there is at the moment any trace of the auditory image in consciousness.

(6) If the image is present and V is identical, the experience appeals to the observer as distinctly auditory, V re-enforces, or flows into, the image; if the image is not present, the experience may still feel largely auditory; V is the same *tone*, a familiar *tone*.

(7) If V differs from N, the process is not, as a rule, felt to be so largely auditory; the attention is entirely taken by a complex 'something' which stands for 'high' or 'low.' (We use these terms advisedly in place of 'higher' or 'lower.') What the 'something' is, depends upon the individual; its core is usually a complex of strain sensations, its remoter elements visual or organic.

(8) Sometimes there is a feeling of difference not standing specifically for either 'up' or 'down.'

(9) If V fails to engender either the reaction of familiarity or of specific difference, the observer resorts to auditory comparison, *i. e.*, he hears the image of V alternate with the image of N. The resulting decision is usually uncertain and very apt to be incorrect.

(10) Pleasantness is the correlate of 'certain' judgments, not of any one of the categories 'equal,' 'higher' or 'lower.'

(11) The verbal formulation arises only after the decision has been made otherwise.

(12) The relation of speed of judgment to certainty of judgment is summarized conspicuously in Table III; that of certainty to correctness in Table IV; that of speed and immediacy to correctness in Table V.

TABLE III.
Correlation of Speed and Certainty.

Observer	IMMEDIATE		COMPARED	
	Certain	Uncertain	Certain	Uncertain
<i>M</i>	119	9	54	52
<i>W</i>	22	4	69	71
<i>S</i>	42	2	17	48
<i>F</i>	161	39	1	40
<i>Wh</i>	194	24	2	33
Total	538	78	143	244

It must be explained that in Table III the compared cases for *W* include the type which he characterizes as "quick comparison," and that the 17 cases for *S* include many instances in which the judgment is deliberated for the sake only of identifying its "feel" with that of some previous test, but without any comparison of images. *L*'s results are omitted because the data are insufficient. It should be further stated that in the case of *Wh*, the correlation is somewhat more detailed than the Table implies; thus, as a rule, instantaneous judgments are absolutely certain; quick are certain; slow, less certain; and deliberated uncertain. The 24 immediate but uncertain cases of *Wh* are nearly all from the longer intervals. There is an immediate judgment of 'plus' or 'minus,' but the difference is so very wide that there is uncertainty. So these few cases cannot be said to make against the generalization that immediate judgments are correct and certain.¹

TABLE IV.
Correlation of Certainty and Correctness.

	D = 0		D = + 8		D = - 8		ALL D'S.	
	r	w	r	w	r	w	r	w
Certain	230	60	217	92	202	83	649	235
Uncertain	72	91	68	67	96	68	236	226

TABLE V.
Correlation of Immediacy and Correctness.

	D = 0		D = + 8		D = - 8		ALL D'S.		
	Observer*	r	w	r	w	r	w	r	w
Immediate	<i>M</i>	38	8	26	7	15	14	79	29
	<i>S</i>	12	3	8	8	5	11	25	22
	<i>F</i>	44	19	67	7	53	12	164	38
	<i>Wh</i>	62	11	62	9	70	6	194	26
	Total	156	41	163	31	143	43	462	115
Compared	<i>M</i>	11	15	12	24	27	17	50	56
	<i>S</i>	2	8	7	9	12	7	21	24
	<i>F</i>	8	10	4	2	11	5	23	17
	<i>Wh</i>	8	4	7	6	9	1	24	11
	Total	29	37	30	41	59	30	118	108

*Observers *W* and *L* omitted for want of accurate data.

¹Cf. the results of Martin and Müller, *op. cit.*, 197 ff.

PART II.

The experimental work comprised under Part II is subdivided into four more or less distinct series.

Series I.

The first series embraces six groups of 36 tests each with introspection recorded after every four tests instead of after each test as before. The qualitative results gained by this arrangement are not detailed enough to warrant its recommendation throughout a whole investigation. They demand a more substantial backing, such as is afforded by the method of Part I, in which introspection is taken after each test. A single time-interval (10 seconds)¹ and a single D (8 vibrations) are employed throughout. The image is actively held. The tonometer is replaced by the Stern blown bottle apparatus.² There are used four standard tones, *a*, *b*, *c*, *d*, corresponding to the settings 2, 10, 18, and 26 of the recording device upon the instrument, and to the pitches 233.6, 256, 276.4 and 300.8 vibs. respectively, and also eight variable tones (*a*, *b*, *c*, *d*, ± 8 vibs.).

The objects of Series I are to get a fairly large number of tests with a single time-interval, to see whether long practice changes the method of judgment, to compare the results of blown bottle tones with tonometer clangs, and to prepare the observers for tests with the bottle tones by the method of continuous change.

The observers are *M*, *S*, *Wh*, *B* (Miss A. M. Baldwin), and *O* (Mr. R. Ogden).³

¹Ten seconds was chosen because it affords a suitable time in which to operate the apparatus carefully and noiselessly, and because it is a favorable period for introspection.

²For a general description, see *Zeits. f. Psych. u. Physiol.*, XI, 1896, 4-12 and XXI, 1899, 361-4. In all the experiments of Part II the bottle is blown by compressed air from a tank in which the pressure is between 1 and 2 kg. per sq. cm., the pressure at the stop-cock being regulated, by manometer guages and a patent valve, at slightly less than $\frac{1}{2}$ kg. per sq. cm. The slight hissing sound of the current of air may be lessened by a 'reducer,' a glass tube of small bore introduced within the large rubber feed tube where the latter attaches to the projecting glass tube of the bottle. Thanks to this device, the hiss was inaudible at the distance of the subjects. It is essential that the cog-wheels be heavily smeared with graphite to stop the rattle of the gearing, which otherwise not only distracts the attention, but, owing to the difference in the sound between going up and going down, indicates the direction of the coming V. As it was, we found it advisable to 'blind' the observers by simulating movements in both directions whether the actual V was to be 'same,' 'higher' or 'lower.'

³The quantitative results obtained from *O* are omitted from the Tables because illness prevented his participation in the work beyond this series, but full advantage has been taken of his introspective reports.

Observer *B* is to be classed as distinctly musical; has taken lessons upon piano and guitar; has done much playing both as soloist and accompanist, especially with the guitar; sings mezzo-soprano; whistles. *B* is very fond of the orchestra; often has centrally excited music, but finds it somewhat difficult to memorize.

Quantitative Results.

(1) The total number of right cases remains practically constant from day to day.

(2) There are very slightly more right cases when $D = \pm 8$ than when $D = 0$, a result quite different from that of the tonometer tests. This difference is, however, due to the difference in the individuals concerned.

(3) Subjects *M*, *S* and *Wh* (who had taken both series) make fewer errors with the bottle than with the tonometer, 413 to 354 on a scale of 540 tests. The manner of distribution of the right cases is the same in both series for *S* and *Wh* (*S* having more when $D = 0$, *Wh* least when $D = -8$), but for *M* the majority of right cases shifts from the column of $D = 0$ to those of $D = \pm 8$, largely on account of the predominance in the bottle series of the error $=$.

(4) As in Part I, the most frequent error is $=$.

Qualitative Results.

All the general conclusions of Part I are confirmed, especially the correlation of immediacy, certainty and accuracy of judgment. On the other hand, this series shows even greater individual differences in the methods of judgment and in the types of error than did the series of Part I. Subjects *O* and *B*, especially the former, being entirely new to the work, exhibit at first a sharp contrast to the better trained observers, but the inequality is soon remedied, and their introspection has the merit of revealing how the methods and standards of judgment of a given individual are liable to alter in a long series conducted under constant objective conditions.

Observer O.

O shows the effect of practice upon both retentiveness and discrimination. At first his images are fluctuating and especially uncertain in quality. Later they are held steadily throughout the interval. Moreover *O* exhibits here what is still better brought out in Part III,—the transition from the slow, image-dependent, deliberate type of judgment to the flash-like, immediate, very certain and imageless type. It is an interesting example of the short-cut tendency in mental operations. In this final stage, *O*'s introspection most resembles that of *F* or *Wh*. The image, which emerges in from one to two seconds after *N*, is in the bottle timbre, steady in quality, varying slightly in intensity with the breathing and often supported by "bodily

feelings," *e.g.*, "Felt image in mouth." "Unconsciously represented the feeling of *N* by moving my pencil-point the way it felt." In his judgments of 'higher' and 'lower,' *O* develops a new type, as they are based upon rather widespread strain and organic sensations. "If *V* differs from *N*, it affects my body differently. I have a rising feeling for higher tones, a lowering feeling for lower." There is one good illustration of the effect of fatigue upon the judgment process. "Got inattentive. Had to repeat the images of *N* and *V* alternately two or three times, yet I had good images and the difference was marked and certain, once I had rendered the decision."

Observer B.

During the second day's experimentation *B* reports that often *N*, less often *V*, rises in pitch just as the air is shut off.¹ This rise often causes the image to be obscure,—" Didn't know which part of the tone to remember,"—and, it is asserted, is the main cause of whatever hesitancy the judgments exhibit. The image appears after an, imageless gap, is in the bottle timbre, located doubtfully in the head, with the usual fluctuations in intensity. *B* thinks that there may be a slight tendency for the higher images to flat, and a slight effort, chiefly facial, to keep them up. *B* has few slow decisions, even from the outset. Unfortunately she is unable to analyze the rapid-certain type, so that the introspective account of her judgments must be confined to a record of their certainty, speed and dependence upon the image. There is little light on the last point. The certain, immediate judgments are made with good, bad and

¹ This phenomenon is also reported a very few times by *O*, and *W*, while *M* and *S* merely say that at times the notes seem like a curved line, swelling in the middle, *S* adding that it is a change of intensity. The explanation of this seeming rise is difficult. Very careful trials show that at a certain position of the air-cock, when the air is nearly shut off, the second partial of the bottle tone can be heard with some distinctness. Now since the movement of turning the valve through a quarter-turn occupies but a brief fraction of a second, and since this partial appears only when the valve is passing through a single very limited position in the arc, it is clear that there can be only an extremely brief variation in the color of the tone as it is shut off. This variation may be perceived, subjectively exaggerated in duration, and misinterpreted as a qualitative change. Besides this, there is the possibility that the simple fall in the intensity of the tone, occupying, say, $\frac{1}{6}$ second, is in itself sufficient to engender the illusion. (Compare the subjective rise in a dying tuning fork tone. Stumpf, *Tonpsychologie*, I, 242 f., 254 ff., II, 237; also incidental reference to rise in tonometer clang, p. 432). If there is any purely qualitative objective error in the blown bottle, it must be a tendency to flat, for if the mercury be replaced by water, or even glycerine, one finds that the thrusts of the air-blast force the liquid, after the first moment of inertia, down the bottle and up into the variator, thus flattening the pitch. We never, however, observed any movement of this sort with mercury, nor was there any observable lowering of pitch. It seems, then, impossible to say whether the rise effect is entirely subjective or an illusion based upon a brief shift in the intensity or color at the end of the tone.

indifferent images; while, on the other hand, poor images sometimes entail uncertain judgments. The solution of this incongruity appears in the fact that the latter condition holds true only when there is general weariness of body, and hence less strenuous attention to *N*. If this be granted, it confirms the principle previously set forth, viz.: that good attention to *N*, not a good image, is the prerequisite of a good judgment. With *B*, the doubtful or hesitating judgments are most frequent when $D=0$, almost nil, 2 out of 60, when $D=+8$, and quite frequent when $D=-8$. It is an obvious corollary that judgments of 'plus' are very certain, rapid and accurate (only one error in 60 tests); and, what is more, the difference is then much exaggerated, *e.g.*, *V* is judged to be a third, a fifth, or even an octave higher than *N*.¹ The introspection does not explain this excellence in 'plus' judgments. We may assume that it is due to some tendency, not further explicable, to pass this decision. 'Equal' was actually pronounced 47 times, 'plus' 72 times, 'minus' 61 times. All certain judgments are made "as soon as *V* begins to sound." A wait of even two seconds would mean a doubtful decision. Fatigue may bring it about that both sorts of judgment take place; there is an instantaneous decision, "founded on impulse," followed by a comparison of the two images. It appears that not only tonal intervals, but also time-intervals are subject to overestimation, for some of *B*'s deliberated judgments are registered as occupying the preposterous time of 10, 20 and even 30 seconds.

Turning to those observers who participated in Part I, we have to inquire what new introspection is afforded by the conditions of the present series.

Observer M.

N causes visualizations less often, blue being especially predominant. Associations are quite frequent, as before: *e.g.*, "Like a cork bursting from a bottle of fermenting cider." "Like cobwebs and dust." "Buzzed in my head like a bee in a paper bag." The judgments are at first varied in nature, but, as practice with the bottle tones proceeds, they settle down into practically two types, the purely auditory for cases of equality and the auditory-visual-motor type for cases of difference. There seems to be much less visual aid than in the tonometer series, and much more muscular aid.

¹Tonal intervals on the blown bottle are overestimated by all the observers. This fact is, perhaps, foreshadowed in the 'rise' phenomenon just discussed; it is further brought out by the distinctions made by the observers between the "high" "middle" and "low" standards used, although the interval from *a* to *d* is but 66.2 vibs., equivalent in this region to about a major third.

Illustrations are: "With equal tones, judgment does not seem to be spatial, but seems to be a flowing together, like a mixture of two glasses of water. It is thoroughly auditory and not at all visual." "Before V sounds, my eyes, which are shut, are fixed on a level; at V they move, or tend to move, up or down, as V dictates, thus denoting higher or lower." "I can say positively that it is not the image, but the first position taken by V that determines the relation of the two." "I feel or see a raising or lowering when V is higher or lower." There is one curious case of disparity between the 'expressed' and the 'felt' judgment. "Verbal judgment was 'equal,' but mental judgment was 'minus.'" With the bottle, difference and direction are both cognized at once, with the exception of one instance. Quantitatively the peculiarity of *M*'s results in this series is the frequency of the error == which occurs 15 times in 60 tests. It seems impossible to explain this frequency whether by appeal to the introspection or to the distribution of the errors when D is ± 8 .

Observer S.

The introspection is very similar to that of Part I. The tones arouse fewer colors than the reed clangs, but perhaps more general associations of objects, most frequent being steam-boats and trains, from the whistle-like sound of the bottle. "Had a vivid picture of something moving very swiftly, like a train. Saw it begin and stop. This recurred through the interval and V was like it." The apparatus is often strongly visualized to hold the image.¹ In the judgments the qualitative change is several times misinterpreted as an intensive difference only. There are a very large number of doubtful cases, —cases in which, had the impulse toward a decision been followed, the majority would have been correct. *S* is able now to distinguish three speeds of judgment; a very quick, completed before V is half over; a quick, made directly after V ceases; a slow, necessitating two or three comparisons of images. Direction is still cognized after, and less easily than, difference, and in one case light is thrown upon the mechanism of judgment as it is conditioned by what might be called ease of reproduction. "I knew the difference easily, but not the direction. Said 'lower' because it is easier to say."

Observer Wh.

In general, *Wh* has similar reports to those of Part I. Like *M* and *S* he has more associations with the bottle tones, *e. g.*, "N tight and strained, like a quarrel or some distressing situa-

¹*Cf. Wh* in Part I.

tion." "The 'choppy' start of the tones is pleasant, like the plunge into water in diving." "Verbal association—'clownish,' a laughable tone as if it tried to be mock-serious, or to be somebody big in vain." The image is in the bottle timbre, localized at the instrument, and held strongly by visualization of the machine. Toward the end of the series the incipient singing mentioned in Part I becomes less prominent. "No tendency to sing or contract the throat now. The idea occurred to me during one interval, but seemed odd and foreign to my present method, though these tones are within the region of my voice." There is none of the double image effect so frequent before, but instead such effects as these,—"Had an idea that there are really two sorts of images, of the same pitch however. One I try to hold; it is weak and bothers me; the other, clear and intense, asserts itself like an after-image, without volition." In the first few days also there is "an alternation between the bottle image and another one in my own voice." On the first trial of the bottle *Wh* has very poor judgments indeed, but it is impossible to say whether because of the newness of the tones or because of the loss of practice during the summer vacation. The judgments take place much as in Part I. The following introspections are inserted, as they make the nature of the process somewhat clearer than before. "Some 'equal' judgments have nothing about them but simple familiarity; there is no tonal reference at all." "In this 'equal' judgment, I had an effect of repetition and coincidence, and an association of touching a place on the skin twice, as in experiments on cutaneous localization, in which, if you happen to hit the point stimulated, you know it because it is more sensitive. Just so my auditory apparatus seems more sensitive to a repeated tone." "The muscular strains which give a spatial setting to judgments of difference are certain enough, but very difficult to analyze farther; they seem simply to stand as symbols of auditory rise or fall and are hence very elusive when attended to for their own sake." "When the D is subjectively very wide, the judgment consciousness is apt to be very spatial. The image is (almost) visualized as a thing here, and V as a thing there, about five inches away, to the right and higher, or to the left and lower." "The verbal contents of the judgment, *e. g.*, the words 'plus' 'same,' are not as usual present until some moments after the decision is made." "Fatigue interferes with the images, but seldom with the judgment." "If the image is good and steady, it is a part of the judgment consciousness, not as a standard of comparison, for it is to V only that I attend; moreover, often the images are poor or lacking, but the judgment goes on just the same."

Series 2.

This section includes two groups of 36 tests with each subject, 10 seconds interval, but made with the tonometer. For the sake of distribution of practice they are interpolated in Series 1, but may be conveniently regarded as a distinct series. The object is to gain additional data for the comparison of the tonometer and the bottle as sources of sound. The image is, as before, actively held; the observers are those of Series 1, with the exception of *O*.

The most obvious quantitative result is that the shift of instrument diminished the number of right cases in the first trial. In the second, every observer improves; the total number of right cases increases 15%. This increase is most striking for *B*, who had never heard the tonometer before. Her introspection shows that the, to her unusual, 'reedy' color of the instrument obscured¹ at first the purely qualitative variations given; quantitatively this influence shows in the fact that in the 24 tests in which *V* differs from *N*, there are nine errors caused by judging 'equal' instead of 'higher' or 'lower.' But these effects are not limited to *B*; even observers *M*, *S* and *Wh*, who have had one year's practice upon the tonometer, find it very difficult to adjust themselves at once to the change in the stimuli; images are at first poor and uncertain,² while the judgments are slowly made, with little assurance or accuracy. As in Part I, the clangs arouse brilliant photisms in the case of *M*, while *Wh* falls back into the habit of contracting the pharynx to hold the image, a tendency which is strong in Part I, but gradually lost in Series 1 of Part II. This tendency seems engendered by the higher pitch, not by the altered color of the clangs. There is also an indication of a shift in the subjective standard of excellence for *Wh*. "I think that what I am calling a good image now is not as a rule up to those termed 'good' last year; perhaps because I don't need the images so much now."

Series 3.

This series comprises two groups of 12 tests with each subject, bottle tones, with 40 seconds interval. The object is to get introspections and data for bottle tones for a longer interval than 10 seconds. The observers are those of Series 2; the image is actively held; introspection is written at the end of each test. A ready signal is given just before *V*. The most

¹ Stumpf, *op. cit.*, I, 235. "Aber selbst die Frage, welcher Ton höher, wird bei ungewohnter Klangfarbe schwieriger."

² Apparently indicative of a loss of practice in ideating a specific sort of image, rather than a loss of practice in attention. Cf. Stumpf, *op. cit.*, I, 75 ff.

striking fact evinced by the quantitative results is one, confirmative of Wolfe and of Angell and Harwood, which we have already mentioned in Part I, viz.: with a long time-interval the number of right cases for either $D=+8$ or $D=-8$ is greater than that for $D=0$; in the present case it is more than twice as great. In other words, with long time-intervals, difference and its direction are much more readily noted than sameness; or, put in obverse form, the two most frequent errors are $=-$ and $=+$. *B* never gives the judgment 'equal' during the entire series; *M* has but one right case in 8 when $D=0$, while, with the other observers, positive judgments of equality are relatively very infrequent. Immediate judgments of 'higher' or 'lower' are, on the other hand, in the predominance, and are made without any trace of the auditory image. The image has, for most observers, become exceedingly obscure and faint by about 30 seconds, and is often entirely absent by the 40th second. Assurance is lessened more rapidly than objective accuracy. The following bits of introspection culled from this series throw additional light upon the course of the image and of the judgment process. "Held image by thinking how it would sound if a man were to sing it" (*S*).¹ "It seems impossible to hold image at all well with my head held erect or backwards. I have to lean forward, and if very anxious, to rest my head on my hands with my elbows on my knees. This attitude seems necessary to attention to the image" (*Wh*). "Image mixed up with another higher image, and they recurred interchangeably. Very annoying. *V* seemed to settle the difficulty, as the lower of the two was at once felt to be the right image" (*M*). (*Cf. Wh* in Part I.) "Muscular strains in throat and chest to keep the image in its proper 'plane,' *i. e.*, I held the muscles of my body up to the 'level' of the tone, and then relaxed to the level of *V* when it came." "I believe I never think the tones are equal because at 40 seconds the image has a sort of 'silent softness,' while *V* sounds terribly loud and material, so utterly different that it is hard to see any sameness of pitch, but real difference I can tell easily" (*M*). "Auditory image absolutely lost. *V* immediately noted as 'away below.' *N* must be held physiologically better than it is consciously, but how, it is impossible to say. These judgments are too quick and surprising to analyze. It is a very odd feeling to have no idea where *N* is, and yet feel that *V* is *below*." "Good strong image, but it sharped slightly. Knew it because *V* was below it, and yet *V* was so strongly familiar that I unhesitatingly judged 'equal' to the neglect of the testimony of the auditory image." "This long interval affects my general assurance, so

¹ Cf. the predilection for low tones and male voices, p. 420.

that while I make very rapid judgments (usually correct also), I don't like to put down 'certain' till perhaps one second after the first impulse comes" (*Wh*).

Series 4.

The four observers of Series 2 and 3 are given 36 tests each, bottle tones, 10 seconds interval, but now, for the first time, with instructions to forget N as soon as possible after it is given. To aid in this attempt, smells are employed as distractors. Some 30 odors,¹ both pleasant and unpleasant, consisting of essential oils, perfumes and powders, are enclosed in similar vials with the names concealed. The observers pick up a vial at random (avoiding repetition) and attend vigorously to the odor at the cessation of N. Distraction is maintained, if possible, until V sounds.

We were led to employ odors as distractors, first, by the successful results obtained from them in this laboratory by a previous investigator,² and secondly, because our preliminary tests had showed the futility for this purpose of such processes as adding and reading. We hardly expected to attain complete distraction for so long a time as 10 seconds, since the earlier experiments had merely indicated a possibility of distraction for five seconds, but, as Table VI shows, we were happily disappointed. When supplemented by the introspection, this Table gives a comprehensive idea of the effect of distraction. From both sources, the following conclusions may be drawn:

(1) *Distraction slightly lessens the total number of right cases for all observers*, though, it may be added, this effect is not due so much to the loss or impairment of the image as to the time consumed by the shift of 'venue' at the moment V sounds; V fails to 'sink in' at first if the distraction be complete.

(2) *We must distinguish four different degrees of distraction*: (a) no auditory image throughout the interval or in the judgment, (b) a momentary, very faint reappearance of the image once, twice (or very rarely three times) during the interval, but entire absence of it thereafter, (c) an appearance of the image near the end of the interval, persisting into the judgment consciousness, (d) no appearance of the image until V sounds, usually not until V has ceased. The Table shows 84 instances of (a), 33 of (b), 13 of (c), 14 of (d), while the sum of (a) and (b) gives 117 out of 144 cases in which the image is effectually eliminated from consciousness during the period of the decision.

¹A set prepared by Fritzsche Bros., New York. For the qualities included, see E. B. Titchener, *Experimental Psychology*, New York, 1901, Part II, 125 f.

²L. G. Burch, this *Journal*, IX, Oct., 1897, 45.

TABLE VI.
The effect of Distraction. (36 cases.)

Image	None		Momentarily in interval		In interval and at V		At or after V only		Not at V		Total right cases	
	Judg.	r	w	r	w	r	w	r	w		Ser. 4	Ser. I
<i>M</i>	14	5	8	0	3	0	2	4	27		27	28.2
<i>B</i>	15	9	5	1	4	3	0	0	30		24	31.0
<i>S</i>	10	14	2	0	1	2	4	2	26		17	21.0
<i>Wh</i>	13	4	15	2	0	0	2	0	34		30	33.2
Total	52	32	30	3	8	5	8	6	117		98	113.4

(3) *The degree of distraction attained varies with the observer.* Thus *Wh* has (a) and (b) equally often, never (c) and rarely (d): *B* never has (d); *S* is most easily distracted to the (a) degree. Under the second heading *B* has the image only at the very beginning, *M* and *Wh* later, at about the 6th second.

(4) If one can trust the small number of cases involved, complete distraction is much more damaging to accuracy of judgment than is distraction of the second type. This conclusion is justified by the introspection. The recall of the image at V is of little avail for the purposes of comparison.

(5) *Distraction in short time-intervals produces in an exaggerated manner certain phenomena of judgment previously mentioned as a feature of long intervals, viz.: lessened assurance, a prominence of spatial elements in judgments of difference, and a greater number of immediate, certain and right cases for both $D=+8$ and $D=-8$ than for $D=0$.*

(6) *The best distractors are those smells that arouse interest, either by calling up vivid and detailed associations, or by being particularly elusive, yet puzzlingly familiar; they may be pleasant or unpleasant.*

Typical introspections are the following: "Image gone entirely, due to the fact that I thought of candied orange slices. Amusing and interesting" (*M*). "Had unpleasant vision 'of camphor balls, my trunk and a dark closet at Sage. It was curious; I was so interested in the smell that when V came, I forgot that I had to make a judgment, at least verbally. However, when I came to write the judgment, I found that I naturally wrote 'equal, certain.' No possibility of comparison" (*M*). "At the very beginning there was a slight image, but it was lost and did not reappear. The odor seemed familiar, but I could not tell its name, and this kept me busy during the interval" (*B*). "Made a conscious effort to think of the smell, its name, nature, probable origin, etc." (*Wh*). "Succeeded perfectly in keeping the image away by vigorous and constant sniffing and by compar-

ing the intensity of the odor with each nostril" (*Wh*). The remaining introspections concerning the judgment are all from *Wh*. "The 'wave back' of the auditory image seems to come when my first wave of attention to the odor dies low. It is not hard to reinstate the smell consciousness. I have a hazy feeling that this recurrence, brief and vague as it is, may somehow make the judgment easier; that it leaves some effect which would not otherwise be there." "At about the 6th second the image was back for a moment. I thought, 'that's not it.' Judgment was made without image, a wide D, spatial-motor setting, and at once came the thought 'that image *was* all right,' *i. e.*, instead of the comparison process, I really checked the image by the imageless judgment." "Good distraction. Judgment immediate, but not quite so fast as in experiments without distraction. There is no hesitation or comparison, but the feeling does not 'flash out' as it does sometimes. Moreover, after many of the quick judgments I have doubts. Often I almost forget what to write; the judgment consciousness is more fleeting. In the previous test the judgment was certain when made, but uncertain at the time I wrote it." "Judgment just a quick impulse to 'plus.' As I wrote it down a sudden uncertainty arose. This uncertainty was clearly due to the presence in the fringe of consciousness of some other judgment. If but one judgment arises I am very certain; if two arise with one distinctly predominant, I am fairly certain; if balanced in strength, I am in a state of doubt and considerable unpleasantness."

This concludes our attempt at the qualitative analysis of tonal memory as it is investigated with the use of discrete stimuli and the modified method of right and wrong cases. In a subsequent article we propose still further to examine the judgment-consciousness by the aid of the continuous change method, and to give a general résumé of the results of both methods.

INFLUENCE OF THE IDEA OF AESTHETIC PROPORTION ON THE ETHICS OF SHAFTESBURY.

(INSCRIBED TO PROFESSOR MAX DESSOIR.)

By M. F. LIBBY.

BIBLIOGRAPHY.

1. **SHAFTESBURY'S WORKS.** 1. Characteristics and Rand's Life Letters and Regimen; 2, Letter to Le Clerc; 3, Introduction to Whichcote's Sermons; 4, Forster, Original Letters, 1830, 1847.
2. **WORKS ON ETHICS.** Fowler, Spicker, v. Gazycki, on Shaftesbury; Jodl, Erdmann, Wundt, Falckenberg, Bain, Leslie Stephen, Sidgwick, Dilthey, shorter accounts of Shaftesbury's Ethics.
3. **WORKS CONSULTED ON AESTHETICS.** Schasler, Bosanquet, Kirchmann, Hartmann, Groos, Vischer Theodor, Vischer Robert, Zeising, Schiller, Kant, Hegel, Herbart, Lotze.
4. **SHAFTESBURY IN LITERATURE.** Hettner, Vater (Pope and Shaftesbury, Halle, '97).

NOTE.—In the British Museum I found a very full bibliography under Cooper, "3rd Earl."

INTRODUCTION.

The following is an essay toward estimating the influence which certain aesthetic notions, and especially those of proportion and symmetry, more or less directly, but often unconsciously, may exert upon ethical theory, and through that, upon conduct.

It is certain that a simple preference for symmetrical arrangement has influenced the political history of countries by affecting the circumstances of debate and the division into parties; and that matters so vital as the size of a family have been affected by a taste for even numbers, or a desire for equality of numbers on the score of sex. In the section on *Proportion and the Good* it will be shown how profoundly such preconceptions may influence a complete *Wellanschauung*; and the ethical importance for good or evil of a sensitive appreciation of artistic form will be suggested. It has long been known that Shaftesbury's views are those of an aesthetic mind strongly interested in moral and religious questions, but the extent to which those views were moulded by two or three closely allied notions, proportion, symmetry, harmony, has never been brought to evidence, and it is hoped that the effort to do so will both demonstrate the permanent worth and rich content of his works, and

at the same time bring into clearer light his relations to later philosophers, such as Schelling and Herbart, whose main thoughts he foreshadowed.

An attempt has been made for the first time to show that the lack of moral seriousness charged against Shaftesbury's Ethics (Butler and many others, and Wundt, s. 327) results not from any inherent defect in æsthetic ethics in general, but only from Shaftesbury's seeming lack of feeling for what I have ventured to call transitional or provisional forms. (See page 491 of this essay.) And this criticism goes so far as to raise the question whether the beautiful in conduct is not rather honor than goodness, and with that whether the good in conduct is not rather pathetic, tragic and sublime than beautiful in the strict sense. This essay was finished just before Dr. Rand's book appeared; that work fully confirms the estimate taken of Shaftesbury's austerity.

A study of Shaftesbury suggests the unexplored wealth of ideas lying hidden in æsthetics and in literature, which call upon modern ethics and psychology for investigation and classification.

§ I. PROPORTION AS UNDERSTOOD BY SHAFESBURY.

The word proportion plays a considerable rôle in various branches of science, such as mathematics, chemistry, music, and æsthetics. Rhetoric has its "law of due proportion," which declares that a thought shall receive prominence according to its importance in the whole piece. In ethics the idea of proportion was clearly grasped already by Aristotle. In æsthetics great stress was laid upon it by the Greeks, but Plotinus discarded the ideas of proportion and symmetry as unessential; and the Greek views of æsthetics had no real vitality from the time of Plotinus to that of the renascence. From the earliest times books have been written on the proportions of the human body. These culminate in Zeising's work in which he argues at great length that *beautiful* proportion can be formulated in the law of the *Golden Section*:— $a:b::b:a+b$, when a is the smaller and b the larger of two parts into which an object is divided. Fechner,¹ Theodor Vischer,² and others raised objections to this theory, chiefly on the grounds, (a) that Zeising³ chose this point of section quite arbitrarily (*e. g.*, in the human body, though the navel, a section supporting the law in a remarkable manner), and, (b) that where an object is divided horizontally the most generally pleasing section is a bisection.

¹ *Vorschule der Ästh.*

² *Das Schöne u. die Kunst.* Pub. by R. Vischer, '98.

³ *Proportionen des Menschl. Körpers, Ästh. Forschungen.*

But both authors were impressed by Zeising's experiments, and found much to confirm the opinion that his theory contains an important truth. Zeising's book contains a history of the idea of proportion. He made extended applications of his principles to moral and religious questions.

In the mathematical usage the word proportion is clear and unequivocal. In every measurable object each part bears a quantitative relation to the whole, but this ratio is not, as such, a relation of proportion. The essence of the idea consists in the equality of two ratios, $a:b::b:b^2/a$. Aristotle understood proportion clearly in this denotation, and declared that it was an idea not confined to numbers as such, but *applicable to all to which numbers can be applied*.

It is sometimes said that the word *proportions* is used where *portions* would be more exact, but this criticism itself is perhaps founded on a misapprehension. It is true that a case of proportion absolutely requires a relation of four terms. If one now should say that a certain mixture requires a certain proportion of a certain ingredient, one might at first suppose that *amount* would be the more exact term. But *it often happens that in a case of proportion the second ratio is understood*. Indeed a judgment of proportion may be reduced in expression to a single term. To use a homely illustration, "That's too much sugar," may mean, the amount of sugar does not bear the relation to the amount of tea in the given case, that the amount of sugar bears to the amount of tea in the most agreeable case. Proportion may be predicated of any measurable objects whose parts can be compared with corresponding parts of standard objects, whether the ground of selection of the standard be beauty, agreeableness, utility, mere fact (standard of height in men, *e. g.*), or any other.

The peculiar quality of *aesthetic* proportion is that the ground of comparison of ratios is *beauty, or some other modification of the aesthetic judgment*,¹ such as humor, sublimity, the typical.

Symmetry is a case of proportion, but involves another idea in addition, namely, that of mirror-like reflection about an axis. In the history of the evolution of the art-consciousness there is observable a mysterious change and advance in the notion of symmetry which may be summarized thus: (1) a love of simple lateral symmetry, as in vases and Greek temples—a kind of symmetry often occurring in nature; (2) the growth of a symmetry of *interest*, *e. g.*, in a picture, a temple balanced not by another temple, but by some equally interesting object, such as a grove with human figures; (3) a tendency of sym-

¹ See Groos's *Einleitung in die Ästhetik*, S. 205, for difference between *beautiful* and *aesthetic*.

metry in the old sense to disappear altogether in a mysterious harmony of the perceiver and the object perceived (mirror-like symmetry of natural object (non-ego) and object in the aesthetic "Schein"), so that pictures, and especially landscapes, of a high degree of spiritual interest, often *neglect altogether the symmetry of composition*. This last way of regarding objects tends to make the selection of the standpoint ("station-point") for sketching less important, and *treats all nature as equally "besetzt."*

But the difficulty about proportion begins when the notion is applied not to simple objects of sense, such as flower-arrangements, cells of bees, shapes and orbits of planets, composition of pictures, structure of temples, etc., but to objects of thought, such as a "beautiful geometrical proof," or of moral ideas, such as benevolence and self-seeking, or of human passions, such as jealousy, ambition, love of honor, etc. The question raised by a study of Shaftesbury is, above all others, this: do terms such as proportion and symmetry (which apply in the strictest mathematical sense to statues and pictures), apply properly (or only figuratively) to the subject-matter of ethical theory? Has the conception of *giving harmonious form to the moral world* any definite meaning? Shaftesbury holds that ethics is a branch of aesthetics, and that the notion of quantity is strictly and most practically applicable to character and to moral or social relations. His view is directly opposed to that of those who teach that "das Schöne ist sinnentäglich," "die Poesie ist sinnlich;" the maxim, "Es muss absolut etwas da sein für unser Auge oder Ohr," before the aesthetic judgment is called into play, does not appeal to his conception of beauty; but when one reads the dictum of Volkelt¹ "ich werde das Menschlich-Bedeutungsvoll als den alleinigen Gegenstand der Kunst hinstellen," or Herbart's bold assertion that moral ideas are legitimate art-material, then one feels that Shaftesbury would have agreed heartily, and that these two principles are fundamental assumptions of his system. The question here is as to what the so-called "concrete medium"² of artistic expression really comprises.

The word *concrete*³ which occurs in so many definitions of art-forms is generally taken to be a perfectly clear and definite term, but it is in reality both obscure and vague. The word may or may not denote an object of sensation, and such words as *act*, *extent*, *grateful*, *reverent*, are quite as concrete as *brick* or *paint*. No one reading the literature of aesthetics can fail to observe that words like *sensuous* and *sinnenfällig* are regarded

¹ *Ästhetische Zeitfragen.*

² *Encyc. Brit. Art. Poetry.*

³ *Jevon's Lessons in Logic*, p. 20.

as synonyms for *concrete*. The most general meaning, in fact, is "physically existing." At first glance, too, this seems satisfactory, but we shall see the results. Marble, bronze, stone, brick, wood, iron, paint, violin-strings in vibration, are the "concrete media" of music, painting, architecture, sculpture; they all have physical existence and offer something to eye or ear. Then, too, take poetry and the drama which Kant and Hegel writing in the age of German poetic genius rank among the arts: poetry has for its medium *language*, which reaches us through the ear, and is also "concrete" or "physically existing." That this view is wide-spread needs no proof, for it is well known that many definitions of poetry declare that words are to the poet what paint is to the painter, etc. But this may have another meaning which we shall discuss presently. Is language, then, in this sense a concrete medium for the sensuous imagination? Does it bear the relation to that which the poet would convey to his reader which marble bears to that which the sculptor would convey to the student of statues? The organs of speech are as real as violin-strings, and the sounds as real as musical sounds; but even if we assume that spoken language is essential to poetry can it be argued that spoken language as such, *as sound*, is an imitation of what is in the artist's imagination in the same sense as a statue, a sonata, or a picture is? It is notorious that when we say a word or phrase *sounds* badly we are hardly ever thinking of its *sound* as such, and that if such expressions were in a tongue utterly unknown their "sound" would not offend.

Language, even as communicated from the printed or written word to the eye, must certainly be said to have physical existence, but every medium of communication of ideas whatever, every such medium conceivable, must have physical existence, hence to pick upon *physical existence* as the defining mark of artistic expression, as distinguished from philosophical or scientific expression, is a mark of confused thinking. Words as sounds are not only not (except in rare instances) known as *imitative symbols* of what they communicate, but they are widely different in different lands, which sharply distinguishes them from such media as painting and sculpture employ, and which are intelligible to all mankind.

The other meaning of "concrete," as applied to poetical language is,—suggestive of a concrete image. The physical existence of the words as objects of sight and hearing certainly does not make poetry art, urge the holders of this view, but the physical existence, or the *imaginary physical existence of the images roused* by the words is essential to poetry. Abstract poetry is no poetry, they argue, and by abstract poetry we mean that verse whose words do not arouse images of physically

existing objects. This position is not easily refuted, is indeed largely true, and requires careful consideration inasmuch as it seems opposed to the idea that moral ideas are legitimate art-material, and to the idea that art may deal with *all that is of human interest*. There is a third class of critics, chiefly close students of painting, and sculpture, and architecture,¹ who boldly deny that poetry is an art in any but a figurative sense; and this opinion is encouraged by the fact that "art" in the universities is apparently confined to the three arts above mentioned.

If we regard poetry historically we do not find that poets avoid moral ideas, or ideas which do not take the form of sensuous images in the mind. It is true that sensuous imagery is abundant in great poetry, but the greatest poets, such as Homer, Dante, and Goethe, have taken the deepest interest in moral ideas, and the English poets have been pre-eminent for their serious consideration of moral and ethical relations and ideas as the names of Chaucer, Spencer,² Shakespeare, Milton, Dryden, Pope, Gray, Cowper, Burns, Wordsworth, Shelley, Byron, Browning and Tennyson, may serve to suggest. In many of the finest modern poems, by Arnold, Whittier, Bryant, Lowell and others, the treatment of the moral interest is the chief means of pleasing; they are certainly not primarily didactic, but they please *in teaching*. Are we to say that these are not poetry, and that their authors are not artists, or are we to define poetry inductively and assume an evolution of the art-consciousness? Is it necessary for one to reject the work of all the great poets in order to cling to the maxim of art for art's sake, or may one here, as elsewhere, allow the conception of growth and development to rectify the definition based upon a mere "*a priori*" or ideal conception of art? If one take a broad view of the term *moral* one may argue that no art product whatever has succeeded in rejecting all moral assumptions, or more or less clearly conceived ethical principles. If we enquire how it stands with the "real arts" in this respect, *do we find that the dream-object is confined to the sensuously interesting?* The facts are precisely the opposite. Indeed it is difficult to think of an old master, from Giotto to Rembrandt, who has not frequently allowed the didactic or the allegorical tendency to carry him too far to be quite pleasing. But within the list of works that are prized as pure art how little the evidence goes to show that the dream-object is not at all concerned with moral ideas. Take the etchings of Rem-

¹ Many admirers of the pessimists consider Music, "die künstlerischste Kunst," as Prof. Dessoir calls it.

² Cf. the remarkable Introduction to the *Faery Queen*, a work of the richest sensuousness.

brandt, take the *Hundred Guilder Print*, the *Return of the Prodigal*, and many more. In statuary take the Greek mythological forms, how overflowing they are with the purest moral significance. Music often has similar influence.

It is true on the other hand that there are poems by Keats and Blake (only a few, however), and paintings by Corot and Whistler, and a good deal of music, which have very little concern for those ideas of man's relation to life and nature which we call moral. These are not the chords, but the overtones of the social harmony, they are the art not of man as he is, a striving and developing being, but of what he aims at being in some ideal republic,—a pure and spiritual *play-art*.¹

From the historical argument it follows that moral ideas are elements of the dream-object. But now it may be objected that while moral ideas enter into works of art they are not artistic elements of those works. In the *Hundred Guilder Print* the lights and shadows are dreamy and charming, the composition is mysterious and suggestive, we easily meet the picture half-way, flow into it, and appropriate it, and delight in it with tender spiritual sympathy. It is true that the picture represents Christ healing the sick, and that his attitude, and expression, and the strange atmospheric effects that surround him, suggest the most moving historical, moral, and religious, and even philosophical ideas, but these, according to the view under discussion, are not artistic elements of the picture as a picture.² Surely this view is untenable. *In any work of art the highest criterion is the harmony and unity of the total impression.* All that is not a help is a hindrance. It may take years of study before a spectator realizes the unity of a picture, but if study only tends to rip it apart how can it be said to be a harmonious whole?³ Now the more one dwells on the meaning of this picture the more its lights and shadows gain in spiritual power, the more beautiful become the delicate drawing and the magical shading, and, therefore, it appears that the moral ideas are harmonized in the total effect, and that they are elements and important elements in the art-effect. Only when the moral ideas in a picture are so obtrusive as to rob one of freedom to enjoy it as a disinterested bystander,⁴ not committed, as a bystander, to any set of opinions, do they cease to be elements of its art. But what follows from this? One result is that the only consideration for the artist is, not to exclude moral or even religious ideas from his dream object, but

¹ Compare Ariel's songs in *The Tempest*.

² Cf. Stern's "Einfühlung und Association."

³ One cannot err in studying art if one strives for the *artist's attitude*.

⁴ The will and attention must be left free.

to keep them under control and to handle them with a free humor, however earnestly. A fair-minded Buddhist could enjoy the *Hundred Guilder Print* because its moral content does not clash with broad ethical truth; but it is a profound error to deny that it contains moral truth because it offends no one.¹

If now it be admitted that moral ideas may be treated as material for art, provided they be kept in pleasing proportions, it becomes necessary to enquire what proportion means in this connection. Here again it may be said, and has, in fact, been said repeatedly, that proportion is a term applicable to objects having physical existence (or so conceived), but meaningless when applied to mere ideas. The arm of a statue may be too large, but how can benevolence be measured? Now it may be made clear at once that objects of thought which have no physical existence may yet be measured mathematically with the utmost exactness. Take for example the idea of *time*. The assertion that a second bears the relation to a minute that a minute bears to an hour is a perfect example (in the sense intended by Aristotle) of proportion, for time is something to which number can be applied, yet time is less tangible than those passions and affections which constitute the non-sensuous or moral element in art. If so "abstract" a conception as time can be measured and divided how can it be argued that mere abstractness contradicts or excludes the proportion idea? When Shaftesbury holds that in literature, in enthusiasms, in ethical motivation and in the contemplation of nature, the chief thing is to preserve a just proportion between the self and the non-self in our affections, it may be said that his idea is fanciful, that there can be no scientific test of symmetry in mere affections; in a word, that æsthetic norms do not apply to the non-sensuous realm of experience. But wherever the notion of number or quantity may be applied there the notion of proportion is strictly applicable. A mere thought or feeling can be measured by its effect; it has (1) duration in time, (2) intensity of pitch or degree, it involves (3) the conception of parts in unity in many cases, and all these elements can be determined more or less accurately, either psychologically or physiologically. But indirectly, too, moral ideas can be measured in the objective realm by the study of historical and social institutions, and by their reflection in art.

Hence, accordingly, so far as the pleasure experienced in symmetry and proportion is the pleasure of a disinterested bystander entertained by watching the play of social forces, just so far can ethics be regarded as a branch of æsthetics, in the sense of Shaftesbury and Herbart, and moral ideas as elements

¹The error lies in the narrow meaning usually assigned to "moral."

in an artistic *Weltanschauung*. Indeed it is difficult to conceive of either unity or harmony in the story of creation except from some such point of view.

It is, then, a fundamental error to assume that art demands "concreteness," and then by a loose juggling with words to substitute "*sensuous*" and "offering something to the eye and ear" for "concrete." What art demands is not the "physically existing," except so far as all experience whatever has its origin in the sense stimulations, nor even the "concrete;" what it demands is the *individual*. *Its dream-object must be single and individual*, not generic. It may deal, and to be great it must deal, with the general case, but *not through class ideas as such*. *Its individual may be the type of a great class, but it must be really individual to be artistic*. Art demands a profound individualizing analysis, just like science, but it requires also an individualized synthesis, and *the most extensive type, which is at the same time the most intensive and true to individual reality*, is the greatest triumph of art. "Long ago, in speaking of Homer, I said that the noble and profound application of ideas to life is the most essential part of poetic greatness. I said that a great poet receives his distinctive character of superiority from his application, under the conditions immutably fixed by the laws of poetic beauty¹ and poetic truth, from his application, I say, to his subject, whatever it may be, of the ideas 'On man, on nature, and on human life,' which he has acquired for himself. The line is Wordsworth's own; and his superiority arises from the powerful use, in his best pieces, his powerful application to his subject, of ideas on man, on nature, and on human life." This passage is from Arnold,² and faithfully represents the teaching of his riper years on this most serious of literary questions. The application of moral ideas to life, he teaches, under the laws of poetic beauty and truth, is the essential distinction of great poetry. Great poets are not content to give form to matter, but they will shape a beautiful character and state, so that the race may at last rise to a level upon which the moral relations themselves may seem a means to an end.

But it must not be overlooked that Arnold defines "moral idea" in a most broad and tolerant spirit: "Whatever bears upon the question 'How to live,' comes under it.

'Nor love thy life, nor hate ; but, what thou liv'st,
Live well, how long or short, permit to heaven.'

In those lines Milton utters, as every one at once perceives, a

¹Critics of poetry often still confine "form" to metre, and show no feeling for emotional, moral, and intellectual "architectonics."

²Essays in Criticisms.

moral idea. Yes; but so, too, when Keats consoles the forward-bending lover on the Grecian urn, the lover arrested and presented in immortal relief by the sculptor's hand before he can kiss, with the line,

' For thou wilt ever love, and she be fair'—

He utters a moral idea. When Shakespeare says,

' We are such stuff
As dreams are made on, and our little life
Is rounded with a sleep,'

he utters a moral idea."

This relation of art to morality, so much disputed by Arnold's critics, critics who share the culture of Arnold and the deep and widespread English knowledge of and feeling for great poetry, goes to the core of the problem of an æsthetic ethics. If morality deals with the whole problem of 'how to live,' and poetry gives proportion and form to moral relations, then Shaftesbury's view is sound; but if "real art" has no concern with moral relations, and other "abstract" questions, then the view still prevalent¹ (that æsthetics has chiefly to do with painting, sculpture, and architecture, and that it is frivolous to treat the "profound dissatisfaction, wholly different from æsthetic dislike, which accompanies the consciousness of guilt," as a problem of moral æsthetics), must continue to predominate.

Shaftesbury declares, and with good reason, that literature is the vestibule of his philosophy. In literature he discerned an art which concerns itself not merely with the beautiful grouping of objects of sense, but with the task of giving form, harmony, and unity to the scattered elements of human character, life, conduct and social relations, the imaginative construction of a beautiful and ideal commonwealth in which the poet should submit to the applause of humanity a conception of the life that would give established beauty of individual and racial conduct and intercourse, and reconcile the problems of freedom, communism, power, purity, and dignity, with the facts of the human body and of nature. This question has been confused by a vast amount of obscure writing, and especially by a vague and misleading use of the words *concrete*, *sensuous*, *form*, *abstract*, *moral*, by a lack of grasp of the significance of the terms *typical* and *individual*,² and by the uncertainty as to the value

¹ This view is no doubt still generally held both in Germany and in the English speaking world.

² The typical is the sublation of individual and general, of analysis and synthesis, and it is for this reason that the character of Buddha or of Hamlet is of ethical and philosophical import.

of associated ideas in the contemplation of sensuous art objects.

The general tendency of Shaftesbury's writings is to extend the territory of the aesthetic *Anschauung* in the direction of making all nature the true art-object, of abolishing the notion of artificiality, and of including the phenomena of character and sociology in the conception of nature.

§ 2. PROPORTION AND ETHICAL MOTIVATION.

Shaftesbury never uses the word proportion without implying an *equality between real and ideal ratios*. When he declares affections to be well-proportioned, he means that certain affections bear the quantitative relation to certain others, for example, egoistic to altruistic, in real life, which they bear to each other in his ethical ideal. This usage naturally leads to the question, how does he establish this ethical ideal? The answer to this question can be gathered satisfactorily from his various works. He regards balance and symmetry as elements of good proportion which appeal *instinctively* to human approbation.¹ He regards this feeling for form as primary, and not derived from the experience or reflection of the individual. Not only are the emotions and propensities upon which morality is based, derived from the natural organization, but also the sense of form by which the affections are judged (both ethically and aesthetically at the same time) is given in the natural organization of man as we know him. But he did not stop with this idea. He regards this instinct for form as being not an artist, but an art critic; it does not say to the individual, Do this, or that, or, Do not do this, or that. The natural impulse forces the individual to do *something*; the natural feeling for proportion reports upon the goodness of the result by a simple *yes* or *no*; it does no work, it assigns no reason, it does not even say *good* or *bad* in any moral sense, but rather *pleasing*² or *not pleasing*, and these terms can only be interpreted to mean well or ill-proportioned.

It follows from this that this aesthetic-ethical judgment is brought to consciousness only in relation to an action founded in natural impulse, stimulated through sensation, and more or less modified by habit or reflection, and consequently it may be said to involve an application of the form-feeling to a manifestation of the stream of power flowing through the nervous system. To what extent a serious disturbance of this stream might produce "that profound dissatisfaction which accom-

¹ In modern phrase "a beautiful ideal network." James, II, 665.

² There is a restful physiological reaction as if some impeded current had found its smooth course.

panies the sense of guilt," when the organs of the body become the records of unharmonious habits or when the soul becomes disordered by passion must be a matter partly of the sensitiveness of the nervous system. When the conception of proportion is combined with that of activity there arises not exactly a conception of form, but rather a conception of *harmony*. It is this idea which leads Shaftesbury to compare the soul to a musical instrument. The *critic* does not say whether the strings have the right form and tension until they are played upon. It is clear from this, too, that pleasure in the ordinary sense is not Shaftesbury's criterion, but the being well-tuned. The reality and agony of a discord of the soul must be thought to be quite great enough to account for the profound dissatisfaction accompanying guilt, provided that the aesthetic judgment apply to the moral world. But in reality Shaftesbury's most formidable critics hold to the vulgar, shallow view of the term aesthetic.

Accordingly, to Shaftesbury virtue is no other than the love of order and beauty in society; and this love of order and beauty in the world leads, he supposes, to belief in an orderly and artistic rule or creative principle.¹ His proof of this position is briefly as follows: The world cannot be thought of by us as a number of segregate unities, but only as a complex of related beings, in which man bears a relation more or less intimate to every other being. Virtue consists in sustaining these relations becomingly, and above all, the relations to the beings most intimately concerning us. The natural desires and needs insure intercourse among men; the love of social order is a love of harmonious natural intercourse, or flow of human activities.

Shaftesbury shows great interest in the problem of the descent of man as discussed by Hobbes, but this gives him no suggestion of inherited modifications of the mental structure; he assumes that the principal affections are inherent in the native structure of the mind. He makes a clear distinction between the intuitively necessary truths of the moral and aesthetic relations, and the knowledge of the outside world, but he expressly abandons the word "innate" (as applicable to the "Formgefühl," as a net of *a priori* relations), in favor of the word "connatural," on the ground that the precise time at which this instinctive knowledge is given can have no practical interest. He never clearly recognizes that his view of the *form instinct* requires him to assume a metaphysical theory as the basis of his system; he speaks vaguely of this instinct as indicating divinity, and yet speaks contemptuously of metaphysics, by which we may be sure he merely meant the university scholasticism.

¹ That Shaftesbury's ideas were of this stoic-pantheistic order is fully proved in Dr. Rand's recently published work.

Aside from this his attitude is that of a man of the world¹ who had attempted to form some kind of ethical *Lebensan-
chauung* for the endless confusion of ethical phenomena which he had encountered in reading, and in experience of life, by an application of the generalizations of the Greeks ethics. Two ideas became selected as the most helpful in reducing this confusion to order, (1) Aristotle's conception of the *mean*, and (2) the conception, original to Shaftesbury, of the balance of the selfish and social affections as the most comprehensive application of the law of the mean to motives of conduct. These two conceptions blended into one general view of virtue. It is true that he enumerates a third kind of affections, the unnatural, which are neither selfish nor unselfish, but merely degrading, but he makes little mention of these except in the classification, and a thorough analysis might show a certain confusion as to their exact relation to primitive altruism and egoism. He has, in general, a preference for the division of any topic into two branches corresponding to his taste for symmetry. He does not distinguish the affections which sacrifice the selfish interests of the present in favor of the interests of society, from those affections which find their own interest in the common interest, though the former alone are strict opposites of real selfishness. In fact the *social affections* in Shaftesbury generally mean the *altruistic affections*. Closely connected with this is Shaftesbury's strong inclination to consider ethics as a problem of our present life, and to treat the conception of future rewards and punishments as of merely pedagogical importance. He is intensely interested in virtue as a terrene phenomenon, and not in virtue as an abstract quality predicable of all reasonable beings.

His view, though so simply conceived, enabled him to arrange the facts of life as he saw it, with much success. To every individual there are two great facts, *self*, and *others*. The ideal attitude of character is the *symmetrical identification* of the self with the others. To incline to either side is to cause either congestion or weakness in the body politic. Even animals have social affections. Female mammals hardly distinguish their young from their own bodies. The young of the human race remain helpless for many years, hence the education of identification through sympathy makes great advances in the human race. This grows into patriotic feeling or identification with and will to die for the tribe, and even for the human race, and leads to the conception of an ideal brotherhood or republic.

¹ Students of Queen Anne's reign will find many reasons why Shaftesbury should appear less austere in his public than in his esoteric utterances, if he was to influence his age.

The love of nature, as of trees, clouds, hills, and streams, is with Shaftesbury a *higher* step in the same process, a finer and higher extension of the enthusiastic sympathy for the non-self, which he calls virtue, or the love of order and beauty in the world. All his writings agree in treating the sympathetic unification of the self and the non-self through comprehension and fellow-feeling as the essence of virtue, and this symmetry is treated as belonging to various steps, the lowest of which is that of the instinctive love of animals for their young, and the highest a poetical identification of the ego of the aesthetic consciousness with the beauty of nature. No one can read Shaftesbury's treatment of the different orders of "forms" with a free mind and not perceive that it contains the germ of Schelling's system of identity, though the germ is only a germ.

This is the sense in which Shaftesbury teaches that a love of order and proportion leads to a knowledge of the divine. The conception of a progressive refinement or culture of the affections is the backbone of his whole system; without this ground of difference between the various stadia of virtue his system would be what it has often been called, a pagan aestheticism. His pure *Anschauung* of Nature hovers on the border between the natural and the mystical, between the understanding and the spirit.¹ A character is virtuous, or has ethical form, when the knowledge and feeling of its own claims and of those of others stand in perfect balance; but both knowledge and feeling become ramified and extended from the narrow confines of a hut of primitive savages to the cosmic outlook of a modern thinker. The peculiar merit of Shaftesbury is his insistence upon balance on the various intermediate stadia. His strong grasp of this idea makes him regard goodness and beauty as identical, and this conception is greatly strengthened by the Platonic idea that perfect, or absolute goodness and beauty are identical. But while Shaftesbury has this clear view of the various stadia of goodness, and of the absolute ideal of goodness, he almost ignores the conception of *process* by which new stadia are to be reached. In spite of the great variety of his ideas, this principle of symmetry, and this lack of sympathy with what one may call broken or asymmetrical forms, go hand in hand throughout his works as the characteristic of his way of thinking. *He vindicates no special or one-sided activities*, whether in art, philosophy, conduct, literature, or religion.

It is characteristic of his view of life that he regards solitude as egoistic, and sociability as essentially altruistic. This view leads him to argue that the study of mathematics is an altruistic pursuit. He overlooks the fact that the most sinister figures

¹*Cf.* Kirchmann's *Aesthetik*. I, 54.

in history have miugled much with their fellow-men, and that the most benevolent have sometimes lived as recluses. It is evident that mathematical acumen *per se* offers no clue to the attitude of the mathematician toward society.

Shaftesbury always kept before him the conception of an ideal commonwealth, and in that sense he may be said to teach that there are not three but four classes of affections influencing human actions. Both this tendency to look *forward*, for one element of motivation, and his bold denial of the reality of evil might be treated in this paragraph, but belong more properly to the next.

§ 3. PROPORTION AND THE GOOD.¹

Shaftesbury says little in his public utterances of duty as such. This conception is presented by him as a striving for harmony of conduct and of culture.² He seems interested mainly in the definition of virtue and of the good. The good in its various stadia is the harmony resulting from well balanced affections, or relations of the ego and the non-ego. Every form of relative good, he says, yields to a better, and all that contains mortal or corruptible elements must finally yield to the immortal and incorruptible. At every step the corruptible elements diminish, while the incorruptible increase. The road to the highest good is the middle path of virtue as defined above. The highest good is the harmony of the highest stadium of refinement and culture.

Shaftesbury is one of those thinkers before Kant who felt deeply that the world is in some way a harmony of disagreeing principles; he felt vaguely that one can stand between these contending forces, and see and feel their opposition, or rise above them and see where they meet in unity, like the meridians at the pole; which melt into unity just where they seem most to clash. When is evil not evil? When it is in a drama, for then it is only a play of the fancy, or when it occurs in a dream, for then it is all in the imagination; when we objectify our total experience, loosen the aesthetic spectator within us, and withdraw into a deeper recess of consciousness, for then we see life, the life of ourselves as well as of others as a play, or as a passing show, or as a dream of the fancy in which not only our bodies but also our souls act their parts.³ Such is the drift of Shaftesbury's argument. This gift of sending the aesthetic consciousness outside the whole realm of experience, including our *own* joys and sorrows, and of viewing the soul and its joys and sorrows as mortal and merely imaginary is marked in

¹ The Moralists.

² Letters to Ainsworth.

³ Schleiermacher—the world as art-work, and God as artist.

Shaftesbury and explains his bold paradoxes. He hovers constantly between a practical and a purely æsthetic interest in the world around him. The street is now a real street, and now an animated picture; the crowd is now a number of citizens, and now a realistic theatrical group; and now again citizens; not from doubt of reality, not from metaphysical idealization, but purely from an intense enthusiastic æsthetic feeling for form and for floating fact upon a broad, powerful stream of imaginative energy. This is the æsthetic *Anschauung* and makes evil seem merely a harmonized element in a work of art, while its mood prevails over the claims of worldly interest or every-day reality.

Shaftesbury felt this strongly, and hence arises his mixture of audacity and unsatisfactory explanation in handling the problem of evil, in which he makes naïve transitions from the position of admitting, to that of denying the reality of evil, with no apparent consciousness of their inconsistency. To the spirit at play there is no evil, but to the spirit at work there is abundant evil calling for intelligence and sympathy.

Shaftesbury repeatedly asserts that what is beautiful and well-proportioned is good, and that what is absolutely beautiful is the absolutely good. He also declares, though less directly, that what is not harmonious and well-proportioned is evil. But in spite of such assertions he is far from exaggerating the identity of the good and the beautiful, as can be seen by the following limitations: (1) He defines beauty¹ with extraordinary austerity, (2) He teaches that there are various stadia or orders of goodness and beauty, (3) He identifies moral ugliness or lack of proportion almost always with (a) excessive egoism or (b) unnatural affections. Accordingly his doctrine of the identity of goodness and beauty means simply that perfection of form is an outward indication that energy and virtue have reached a certain stadium and received the reward of striving, in the harmonious activity of the forces and affections involved. While the affections are divided the egoistic are evil; but he does not vindicate heroic altruism, and regards it as asymmetrical. *It never occurs to him that heroic self-sacrifice in the individual may tend to symmetry in the state;* hence his defective sympathy for Christianity.

Besides this discussion of evil there are three other discussions which Shaftesbury treats as preliminary to his doctrine of the highest good: (1) the meaning of the word "natural," (2) the probability of miracles, (3) the existence of God. We have

¹ The emphasis given throughout this essay to the inward stoicism of Shaftesbury is more than confirmed by Dr. Rand's contribution to our knowledge of his esoteric faith.

to do only with the influence of æsthetic ideas upon these questions.

The word natural means either governed by the instinct given primarily by nature, or governed by affections occurring in such proportions as to produce harmonious conduct on a higher plane; that is, by a refined¹ and conscious, but yet adequate, naïve and harmonious, substitute for instinct. So long as man's instinct was purely undivided and unconscious he was not really a moral being. So soon as he began to reflect upon his conduct, his instinct became divided into affections. These affections must be selfish or unselfish. Even wolves love their young and identify them with themselves to the point of dying for them. The higher stadia of life differ from the lower, not in the balance of these affections, but in refinement and self-consciousness. *Unnatural* means lacking in instinctive balance on any plane of moral conduct. On this idea rests Shaftesbury's whole structure of moral good. To Shaftesbury a return to nature does not mean a return to ignorance or savagery, but to the well-proportioned affections of instinct on new stadia of progressive refinement.

He relates the discussion of miracles to his æsthetic ideas in the following manner: All nature is a miracle; the true modern transubstantiation is the perception of a bit of nature as "*beseelt*"; at a rude blow the hamadryad may desert the tree. Shaftesbury shows a half serious enthusiasm for nymphs and hamadryads. But these Greek miracles do not disturb the order of nature. The true miracles are always present and require *not to be performed, but to be perceived*. There are minds so ill-regulated that the order of nature does not kindle the sense of divinity; these think that any violation of natural law through prodigies would offer proof of the reality of spiritual forces. But miracles, he says, though they would be proof of power would not prove goodness in the agent, and hence not God. They would unhinge nature, bring confusion into the world, break its uniformity, destroy that admirable simplicity of order from whence the one infinite and perfect principle is known. The world is, he says, not a self-governed, but a God-governed machine.

The æsthetic argument for a God he bases upon the principle that while religion cannot be founded upon a system of rewards and punishments, it can be founded upon the principle of love; and the love of God can be immediately perceived in the beauty of nature. He does not hold that every man can see the beauty of nature in this way. But great leaders per-

¹ By "refined" I mean here "sharpened" rather than elevated or exalted in the Christian sense.

ceive it and teach the race. Man's very struggle for knowledge destroys his harmony of perception, but the time will come when through adequate culture men may return to nature. He admits that while knowledge is imperfect it is impossible to prove that the universe is a harmony, but he claims that the more we learn of natural law the more reason we have to believe that nature is all governed by one spirit.

It is clear that he can have but one conception of the highest good, and he states with explicitness that to know the truly beautiful with genuine enthusiasm, and thus to achieve continuous and intense harmony is the *summum bonum*. On lower stadia proportion and symmetry are signs of harmonious affections, but the absolute beauty must be free from lower interests. "*The absurdity lies in seeking the enjoyment elsewhere than in the subject loved.*" This fine conception lies at the core of the æsthetic ethics. The psychological basis of the perception of the truly beautiful is in an affection which he calls sometimes enthusiasm, and sometime love, and which seems to coincide with the social affections in a high state of activity. Shaftesbury's ethical structure comprises a series of stadia upon which this affection seizes upon larger and larger circles of the non-ego to identify them with the ego. This process develops with increased knowledge and intercourse. It involves not only offspring, clan, country, and the human race; but finally (animals?), plants, mountains, seas, sky. When the more remote and insignificant parts of nature are saturated with this identifying sympathy it begins to be seen that the beauty of nature is literally a divine beauty, and that the soul is face to face with, if not identified with, the creative principle.

There are, he says, "three orders of forms:" (1) material forms, (2) forming forms, and (3) forms that produce forming forms, by which he says he means the procreative power. These three stadia are an æsthetic reading of body, soul, and spirit. The third order can produce minds, just as the mind itself can design material forms. That which fashions minds themselves, contains in itself all the beauties fashioned by those minds. These forms are the fountain of all beauty.

But this creative principle in man is the same which gives beauty and government to nature. It is the principle of beauty within us, our intuitive knowledge of form, that teaches us to recognize the beautiful, without instruction from others. The energy with which Shaftesbury explains that the pure attraction of beauty, an attraction absolutely *independent of the actual existence of the object admired*, must be distinguished from lower attractions, is nowhere surpassed, and is the germ of all that is best in Kant's *Kritik der Urteilskraft* and in Schiller's æsthetic letters. The highest attainable good is the harmony of the

being, involved in the perception of spiritual beauty through sensuous representation. The idea is essentially one of freedom. It can hardly be said that Shaftesbury taught an Identitätssystem, yet it is mainly, perhaps, his aversion to metaphysical speculation that kept him from making the step thereto. The creative energy in man occurring on the most refined stadium of culture, freest from narrow interests, finds itself in complete harmony with the creative principle in nature, showing as the beautiful. The world is thus perceived as "*beseelt*." There is no desire to see it other than it is, to perform miracles, because there is no possibility in this state of any *desire* of any kind whatever; harmony is precisely the condition in which desires are at rest. The soul perceives the divine beauty of the world and assents to its goodness. What is not seen as perfectly good is not seen as *beseelt* and harmonious. This is to see the miracle of creation and in a sense to see it from the point of view of creator; but this state of mind can hardly be called moral, inasmuch as it occurs at a point where the consciousness withdraws from interested relations.¹ Shaftesbury considers the human form as a part of nature, and as its most beautiful object. It was from him that Schiller took his idea of the difficulty of seeing the human body aesthetically.² In the *Moralists*, where he expresses so passionately his feeling for the spiritual beauty of nature, he confines himself to the beauty of landscape, because he knew that it requires almost superhuman elevation of mind to treat the human form as a pure aesthetic phenomenon. This passage was the key-note of the chorus of nature-poetry that began a few years later with *The Seasons* and which has been a main element in literature ever since. Shaftesbury's influence on Pope's verse³ has been elaborately exploited, but his influence on Thomson, Cowper, and Wordsworth is far more important to us. Shaftesbury's connection of the highest good with a pure and intense *Anschauung* of nature and with the third or creative order of forms in man is full of suggestiveness, and foreshadows another problem of aesthetics, that is, the relation of beauty to sublimity on the highest stadium of appreciation. It is true that Shaftesbury speaks of nature thus perceived as beautiful, but the discrimination of beauty and sublimity was but ill-understood by Burke many years after Shaftesbury death (1761), and was not understood in the modern sense before Kant's definitions (1790). Shaftesbury expressly states that the sublime places of nature, great forests, mountains, caverns, are most favorable to the contemplation of God. In this,

¹ Neither *immoral*, nor *not yet moral*, but *prætermoral*.

² Letter 26.

³ Paul Vater.

as in many other respects, he foreshadows modern æsthetic views.

It becomes clear upon reflection that nature, seen as the immediate expression of divinity, cannot be called beautiful without at the same time being called sublime. In spite of certain differences between the definitions of Kant, Hegel, and Vischer, on the one hand, and of Fechner, Hartmann and others on the other hand, there is a general agreement that a sublime object must in some sense be great or mighty (*gewaltig*), that it must arouse a sense of fear and weakness in the spectator, and that this feeling must be followed by a pleasing sense of the superiority of mind over matter. (It seems that the tragic in the moral world arouses fear and pity in the spectator, but also gives pleasure by being perceived in the æsthetic *Schein*. This analogy has sometimes led to a slight confusion between the terms *tragic* and *sublime*; Shaftesbury uses the word *sublime* rather of conduct than of sense-objects). Kant teaches that, in the sublime, perceptions are not compared with conceptions of the understanding, as in beauty, but with ideas of the reason. Its effect depends, therefore, upon a *disproportion* between sense-perceptions and ideas of reason. The German *Æsthetik* in general derives the sublime from the "Vernunftidee des Unendlichen." There seems to be a great deal of¹ *relative sublimity* which does not quite arouse those ideas of the soul which we call *unendlich*, or absolute, or divine; but certainly the sublime is most effective when it does so affect us. (Ex. Coleridge's *Hymn to Mont Blanc*.)

On the contrary, the beautiful, instead of exalting the spiritual part of man and humbling the sensuous, brings a feeling of harmony and proportion between the sensuous and the reflective powers of our nature.

Hence, accordingly, it would seem that Shaftesbury's beauty of nature is not mere beauty: (1) because he views the whole earth, mountains, oceans, sky, with a comprehension of their enormous magnitude and power, (2) and because his contemplation ends in a referring of all this to a spiritual being. But on the other hand all these sublime elements are seen by Shaftesbury as a vast and *beautiful* harmony, while the *sublime as such is always characterized by a certain isolation*,² and, short of its solution in catastrophe, a certain *insolubility*. Can an object be both sublime in the strict Kantian sense, and beautiful at the same time? The answer to this is that before an object can really be perceived as (absolutely) sublime and (absolutely) beautiful at once it must arouse in the spectator a har-

¹ Cf. Karl Groos, *Einleitung in die Ästh.* S. 310.

² Just as the tragic is characterized by loneliness, as in Hamlet, Macbeth, Timon.

monious perception of spiritual powers which *wholly* satisfies the aspirations of the intellect at the same time, and this could only mean that the object is known by a mind which perceives the sense object as a spiritual creation (or in other words by an intuitive intellect in which will and power are one, and the understanding a mere channel of communication). Shaftesbury probably does not strictly mean that the harmony between his soul and the *sublime beauty* of nature amounts to a sense of creation, but merely that it offered a presentiment of such a sense. Or if he *really* believed that he perceived the soul of nature in the beauty of the landscape, it is yet possible that this belief was the error of an enthusiastic, sensitive, and aspiring mind. The efforts of poets to see the world from this imaginary point of view frequently lead to poetry in which a high degree of beauty and a high degree of sublimity are more or less successfully blended. (Ex. Faust I. Prolog. in Himmel, V, 1-28.)

It follows from this that the highest good, as taught by Shaftesbury, is an æsthetic delight in nature, including man; in this state beauty on its highest plane forms a union of sublime elements, and the attitude of the beholder is that of an artist rejoicing in his work with a full critical appreciation, but with no thought of merely understanding it or fearing it, but of taking an ecstatic pleasure in it. In the progress of the æsthetic consciousness toward such an ideal, it is clear that the sense of sublimity must extend enormously before all objects can be received into an æsthetic *Anschauung*. It is probable that as knowledge increases and sensibility keeps pace, not only mountains, oceans, storms, are regarded as sublime, and not only the earth as a vast ball in space, but even small and hitherto insignificant objects which science has discovered to be examples of great natural laws. The *feeling* that should be inspired by natural law comes very slowly, yet both knowledge and feeling are implied in any progress toward freedom.¹ *In the days of Kant the view of sublimity which prevailed in literary circles was crude if not vulgar from our point of view.* Many parts of Schiller and Byron which thrilled our ancestors leave us cold. The average literary student of to-day in England or America accepts Matthew Arnold's estimate of Byron and Wordsworth as substantially correct,² though the Germans still regard Byron much as the English did long ago. Some modern poets find sublimity in objects that were once thought mean and trivial, and the tragic is no longer confined to the great and powerful, and indeed, in some instances, has been seriously extended to the fortunes of animals, if not of plants.

¹ Knowledge and virtue are identical only when knowledge includes the *feeling* which belongs to it.

² *Trent* on the Byron revival—but he does not refute this view.

Sympathetic identification of the self with the non-self follows, slowly, upon the searching analysis of scientific investigation, and begins to construct a spiritual, but not a superstitious, *Weltanschauung* nearer to that which presented itself to the insight of Shaftesbury.

Shaftesbury's view of the identity of the supreme good and the supreme beauty resembles that of Plato in many respects.¹ But Shaftesbury's clear and original grasp of the necessity for balance between and sympathy between the self and the non-self brings him very close to the present age. He may be said to stand midway between Plato and Schelling.

§ 4. PROPORTION AND ENTHUSIASM.

Shaftesbury deals with three chief points concerning enthusiasm in its relation to proportion: (1) What is the nature of the quality called enthusiasm? (2) What is enthusiasm in the derogatory sense? (3) What is it in its best sense?

He made a highly original effort to see a mysterious psychological phenomenon in a reasonable and philosophic light. He considers enthusiasm both from an ethical and from a metaphysical standpoint (*i. e.*, in its relation to reality), and makes an attempt to comprehend both views under the category of æsthetic form.

Shaftesbury takes the conception of enthusiasm very seriously. He uses the word partly in its Greek sense (*ένθουσία*), and partly in its relation to those terrible outbreaks of religious mania which were so widespread in the middle ages.² Hence the mysterious suggestiveness of the word in this essay. In no case does he employ it in its usual modern English sense.

In the *Moralists* enthusiasm is spoken of as a *sense* by means of which the "divine beauty" of nature may be apprehended; that energy through which nature may be perceived in the æsthetic *Schein* as understood by Shaftesbury, who as a student of Plato (v. Rep. Bk. X) had grasped that conception as firmly, though not as analytically, as Schiller and Hegel. In the *Inquiry* he has based the conscious moral activities in the animal affections. While these are below the state of reflection they are neither moral or immoral, but non-moral or sub-moral. In the moral realm they show normally (he speaks also of unnatural affections) as selfish and social.

Enthusiasm may be described as a state of the soul in which the animal energies, acting on various planes of consciousness, urge the individual to extraordinary activity of body or mind. When this extraordinarily energetic impulse reaches a very

¹ Republic, VII, 517.

² Cf. *Dancing Mania of Middle Ages*.

high plane of consciousness it produces, perhaps, a knowledge or power which the understanding does not possess, such as the power of perceiving nature through æsthetic intuition as "*beseelt*."

Enthusiasm in general implies a preponderance of natural energy over culture with a consequent lack of repose or stability. If the mind is cultivated adequately in many directions it makes a reasonable use of the energy supplied it by nature in the performance of its ordinary functions. On the other hand, if the mind has few or fragmentary lines of thought, and yet is supplied with a great flow of activity, it is always in danger of being roused to fury by the rush of superfluous energy into some complex out of which it cannot find a way for itself. The tendency of this impulse to discharge itself in action makes persuasion of no avail, because the outlet offered by any suggestion of reason is too slight to give relief.

Hence enthusiasm may be said to be bad when it occurs in relation to a notion not standing in well-proportioned relation to other notions. Humor is a peculiarly effective means of drawing off the energies of a fanatic or a mob from their fixed ideas if employed in good time.

The Greeks had enthusiasm with well-proportioned culture. Their *Weltanschauung* was broad and complete; though their knowledge was not minutely ramified, yet it was comprehensive, and was crowned by a mythology in which the muses gave them a *provisional or fanciful outlet toward reason*,¹ which though poetical was sane and natural. Aristotle and Kant do not take their categories more seriously as a set of meridians toward truth than Shaftesbury takes the Muses as guides to the Elysium of the æsthetic *Anschauung*. The Christians, he says, pity the Greeks, but their religion as humorless, fanatical and "soul-saving," is inferior in symmetry, naturalness and breadth. God, he says, with naïve anthropomorphism, is to be conceived not as severe, pompous, imposing, but as sweet and good-humored. Ill-humor is the result of narrow culture, or of opposition, but God can have no ill-humors, for in him all the energies get their appropriate play, and he is not opposed.

Enthusiasm, accordingly, is good when it produces an energetic, well-balanced activity in ordinary minds, and it is best when it, through natural power and well-balanced habits of associational thinking rises above the mere intellect to the energy of poetic genius, of artistic inspiration, or spiritual intuition.

In this essay on Enthusiasm, Shaftesbury shows a lack of

¹This is a main use of great poetry.

appreciation for the sublime, the individual, the tragically persistent, the inadequate but struggling idea. He has a vivid conception of what is harmonious for mankind or for a single fortunate and cultured person. But he never grasps the greatness of a man or a nation with a mission, a peculiar and divine vocation; hence his bitter contempt for the Jews as one-sided gloomy fanatics, and his preference for the joyous Greeks. He quotes with fine literary effect the saying, "though I give my body to be burned and have not love, it profiteth me nothing," but fails to see that in the *community*, "form" can be achieved only by self-sacrifice. To love the public, to study universal good, and to promote the interest of the world by making our best views prevail, is, he says, "that temper which we call divine." But this temper of making the good prevail must, he insists, be "*unbiased*," because otherwise we cannot "judge the spirits whether they be of God." His dislike for vulgar enthusiasm is a distaste for bad form. His dislike for an intimate personal religion, a "soul-saving" religion, is a disgust for bad manners. Shaftesbury, like Plato, had a remarkably strong grasp upon the simple principles of form, such as symmetry, proportion, unity. But it would be easy to overestimate his artistic gifts, for he shows little sense of structure as a prose writer, and his notions of art are the notions of a *thinker*, with no convincing sense of individual reality. He has a strong artistic impulse, but little physical basis for it, and no technical training. With convincing sensuousness, and training in observing and handling the individual case, he might have been an artist; for the enormous respect for form and art, which he continually displays, is not more remarkable than his taste, energy, and sensibility, his insight into character, his sympathetic humanity, and his impassioned love of truth and justice; all characteristics of the greater artistic or poetic temperament.

One might say that he had a horror of that sublime enthusiasm which, with some narrowness, but great singleness of purpose, has no thought of beautiful form in any relative sense, or on any lower plane than its particular "kingdom of heaven," but pursues the infinite and absolute in severe and disciplined striving. Shaftesbury was all in favor of broad, joyous, well-proportioned solidarity. Yet in his own inward life the beautiful in all its fullness reached the sublime level, and like his Greek masters he believed that he perceived not the shadow but the reality.

In Shaftesbury's last writings¹ enthusiasm is related to melancholy and even in a sense to sublimity. But melancholy is

¹ *Miscellanies.*

pathological, and the true sublime is not tragic melancholy, but a feeling of serene divinity ("There is a power in numbers, harmony, proportion, and beauty of every kind, which naturally captivates the heart, and raises the imagination to an opinion or conceit of something majestic and divine")."

This *right enthusiasm* shows as (1) the courage of the true soldier, and (2) the genius of the artist, (3) it is the means of perceiving the really beautiful, (4) it is the spiritual element in sexual love, and (5) the flame of *pure friendship*; (6) through it, *religious feeling* becomes "an astonishing delight or ravishment."

The *false enthusiasm* takes the form of fear, melancholy, consternation, suspicion, despair, and, above all, superstition, belief in evil spirits, and experience of morbid and degrading religious ecstasy.

His most fruitful new application of the idea in his last work is the suggestion that history may be regarded aesthetically. In Greece life was well-balanced, and beauty was generally worshipped. But when Rome came to rule, the power of that terrible empire tended to raise "an expectation of a divine deliverer." This conception is endlessly suggestive of the analogies between psychology and history; it is in striking accord with the aesthetic theory of the relation of the sublime to the terrible, and with Schelling's view of history. Taken in connection with his conception of the highest good as a sublime-beautiful *Anschauung* it would suggest that in an ideal commonwealth the Christian sublimity of spiritual power would be combined with Hellenic proportion and harmony.

His general doctrine regarding enthusiasm is that it is the *power* of the human mind, and that it is capable of almost any kind of results, depending upon the *direction* and *proportion* it receives from the reason; a means for complete slavery or perfect freedom. This enthusiasm he regards as the activity common to body, soul, and spirit, and he makes a vehement appeal for the view that form is a conception strictly applicable to the inner experience. His view is, that no matter how much knowledge and energy society may have, it can never have freedom and harmony until all the parts of its achievement are related in a well-ordered form. Harmoniously related *form* is the aesthetic contribution to ethics.

§ 5. PROPORTION AND LITERATURE.

Shaftesbury conceived that the function of literature is to show in a pleasing form a true image of the world, and especially of the relations of character and conduct. To treat the world of moral relations as material for artistic form by giving it expression in particular persons and situations is to be a lit-

erary artist. But this can be done well only by one who has a comprehensive sympathy for his fellow-men. *To identify one's self through imaginative sympathy* with all kinds of persons, to see the world as one's self, and to judge it as one judges the corresponding phenomena in one's own character, is to have the literary point of view. But to be an artist of conduct and character one must be self-critical. Our true genius or guardian spirit is our æsthetic consciousness retreating into the distance in order to judge the composition of our own soul, and "according as this recess is deep and intimate" we can see ourselves truly and obtain that knowledge which fits us to judge others wisely. Shaftesbury's position is as follows: The body is the seat of pleasure and pain, the soul, of hope and fear, joy and sorrow, etc., etc. The consciousness may be more or less fully identified with either body or soul; but the consciousness may withdraw from its immediate locus in either body or soul without, however, failing to do justice to the comparative reality of either; in this recess the consciousness is the literary bystander; the æsthetic spirit. It sees the world of passion in its own soul, but does not particularly distinguish its own soul from the souls of other human beings because through sympathy it holds their joys and sorrows to be equally related to it.¹ This point of recess is the center of all human experience; the artistic spirit knows the joys and sorrows of the race not less but more deeply than the practical consciousness, but it perceives individual experience, whether in its own case or that of others, to be part of an harmonious masterpiece.

The question has often been raised, why do we take pleasure in tragedy, and why is the pleasure great in proportion as the pain is great. Kant's teaching of the sublime shows how the painful becomes pleasurable when referred to the infinite. Shaftesbury's view is very broad, and may be stated as follows: from the deepest recess of the æsthetic consciousness not only the terrible and tragic, but *all the phenomena of body and soul* appear to have only *imaginary reality*, and the deep pleasure of the æsthetic *Anschauung* is in the sense of power and harmony which arises from unifying and transcending experience, while not ignoring its comparative reality, but rather most fully recognizing it.² Only from this point of view can one know the world truly, all others are unfree and onesided. Poets, lovers and mystics, he says, aim at seeing the world imaginatively, but they often lack the deep and well-rounded self-knowledge demanded for the task. This is Shaftesbury's

¹ The contemplation of a play should not excite the *will*, except in boors.

² "He that will all the treasure know 'o the earth, must know the center too." Shakespeare.

idea of proportion applied to literature as it has been already applied to virtue, the highest good, religion, and philosophy. This inner architecture, he says, must be applied not only to the character, but to society. We are to seek the moral Venus as distinguished from the sensuous. We are to use our sense of æsthetic form to improve our moral proportions, and this improvement will, in turn, improve our sense of form. Shaftesbury has always before him the conception of an ideal commonwealth where all will be beautiful and good, and the image of this state, as conceived by the poet, should be an incentive to progress. "Such a poet is indeed a second maker, a just Prometheus under Jove." He holds that only poets of just character can produce beautiful ideals, "for knavery is mere dissonancy and disproportion." He even thinks that music must have done much to promote civilization by setting up an idea of harmonious relations.

Even in art he dreads the discordant effect of selfish interest. Any workman who loves his work as such, and is proud and independent regarding reward, is a true artist,¹ and this spirit of idealism and æsthetic joy in the daily work, he declares is "real virtue and love of truth! independent of opinion and above the world!" In the same vein he praises Shakespeare because he pleases "without a single bribe from luxury or vice." He is far from advocating that literature should teach morality, he does not want moral purpose but ideality—beautiful moral proportions. "It is a due sentiment of morals which alone can make us knowing in order and proportion, and give us the just tone and measure of human passion."

It is because he thinks literature a good basis for ethics that he thinks it a better discipline for a philosopher than metaphysics. Literature is worthless when it is "Gothic or barbarous," by which he means lacking in design or unity of design. "Nature," he says, "cannot be mocked," that is, all that is ill-ordered must quickly disappear.

Accordingly, in literature as in other matters, it is only the regularly beautiful that appeals to Shaftesbury; not the striving for deeper spiritual content regardless of regularity of form as in the pictures of Dürer, but the repose upon an achieved stadium of perfectly formed beauty and perfectly adequate expression as in the works of Raphael. Yet Shaftesbury desired the highest degree of spiritual content. But he did not like those great transition movements by which what he esteemed the highest ornaments of literature are reached. He is not impressed with the tremendous complexity of the problem of transition from stage to stage of æsthetic and ethical forms,

¹ Bosanquet's *Æsthetic*, 452-3.

or of the relative values of those masters who have and who have not symmetry and proportion.

In his latest utterances he shows a deepened sense of the truth that proportion has new significance as the social relations widen. This is observable in his remarks on patriotism as an ethical form midway between egoistic-family and egoistic-race affections. From his new point of view he seems to rank the egoistic-fatherland affections first of all. This agrees with his general moderation of opinion.

These are problems intimately related to literature and ethics. His conception of manners and morals as the same thing on different planes has also something fresh and interesting as indicating his tendency to see patriotic and cosmic affections as an expansion of the narrower forms of alteregoism, as shown in love, family, and party relations. Had he been given to metaphysical speculation he might have come to regard metaphysics as an egoistic universal form analogous to patriotic and race interests but more expansive still. When he says "to philosophize is to carry good breeding a step higher," he utters a half-symbolic truth about good form, very characteristic of his standpoint.

Another later thought is his application of good form to pedagogy, and though he says little, the topic is suggestive of the enormous importance of natural form in the complex associated ideas of youth, and of the danger of abstract, fragmentary, and inadequate ideas. He represents the English notion that balance and manners are the object of education. The teaching of this system inculcates honor rather than goodness or learning. It may be safely asserted that all specializing in single branches would have seemed to him dangerous, as tending to congestion and lack of balance. He favored those studies, such as music, poetry, history, etc., which tend to develop the mind all round. He identifies proportion with health and beauty. He does not see that harmony on higher stadia may be favored by sacrifice of harmony, or "that we should things desire that do cost us the loss of our desire,"¹ and yet desire rightly; hence, as was said in another connection, his defective sympathy for heroic Christian ethics.

§ 6. COMMON SENSE AND PROPORTION.

Sensus communis, says Shaftesbury, is not good sense, so much as the good *feeling* resulting from a fair and just view of the rights of all men.

In religion the opposite of common sense is a gloomy asceticism which despises the world and allies itself with the super-

¹Two Noble Kinsmen, V.

natural. In philosophy nothing is more opposed to common sense than the doctrine that man is by nature entirely selfish. In the course of the argument he declares that "it is the height of wisdom to be rightly selfish." It is manifest that common sense is another name for Shaftesbury's social affections; a term, as has been shown, which he uses not in the sense of altruistic, but of alteregoistic affections.

His arguments in favor of common sense are: (1) Friendship is admitted on all hands to be an intensely human quality, no ridicule of which is tolerated by the race. Yet this quality is eminently alteregoistic; that is, a matter of give and take; it is the virtue of a joyous and natural people. (2) Poets and musicians show in their love of harmony, and in their desire to please and benefit others, that they are filled with *common sense*, and they are accordingly accepted by common consent as true human types. (3) Lovers are regarded by all as natural human types, yet no true love is merely selfish. (4) The beauty of women also lies in a mysterious sympathetic expression which indicates the opposite of the selfish and sensual qualities which Hobbes and others regard as natural to humanity. (5) Even in war it is a mistake to regard humanity as merely selfish and wolfish. The soldier is a wolf toward the enemy, but nowhere else are so many acts of splendid self-sacrifice and tender devotion to be found as in the relation of the soldier to his comrade and his home. The coldest men are the slowest to take sides. (6) To be truly cultured is not to be selfish, but to have a fine and broad sense of proportion. Shaftesbury uses the humorous argument that if Mr. Hobbes had not been desirous of helping the race he would never have taken the very serious risks that attended the publication of his heterodox books.

Shaftesbury's view is that a normal man will do no wrong and take none. His argument is not against a full measure of selfishness, but against injustice. The natural conclusion is that a man of sense claims his rights, and that he who does not is "too good." To be perfect is to be well-balanced. To renounce one's rights does not seem right to him. He makes no distinction between the individual and the state.

This grave fault in the system has been dealt with by Butler and many others from the ethical point of view. *But the defect is just as marked from the æsthetic side.*¹ Shaftesbury continually speaks of the contrasted affections without observing that both classes struggle from plane to plane. A man may be unselfish about food, clothes, and pomp, precisely because he is selfish about others matters, such as scholarship, or fame. A

¹ Æsthetic ethics has suffered from Shaftesbury's error regarding the need of symmetry in individuals; it must be admitted that he was wrong before a satisfactory form can result.

prophet or religious leader may despise not only material, but also intellectual rewards because of a selfish desire for spiritual knowledge and power, visions, prophecies, ecstacies, miracles. It is evident that balance upon any of these planes would give an adequate and powerful ethical form *so long as the form remained unbroken by the ideas of new desires*. But the number of such planes of conduct is infinite. A man leading an intellectual life reaches a seemingly satisfactory form or set of opinions about life, in which his ideas and energies are balanced and connected, and lead to appropriate actions. But a new idea¹ rouses scepticism, doubt, hesitation; thought and action get out of joint, and the form is no longer adequate for naïve and healthy activity. Without these sceptical suggestions, often the promptings of ambition, there would be no rupture of well-proportioned views, but there would also be no progress in refinement and expansion of ethical forms. Shaftesbury, who is keenly conscious that only the pure spiritual *Anschauung* is the finally true form (the "third form" of the *Moralists*), often fails to apply this necessary conception when praising *mere lateral symmetry* of affections. He sees clearly that there are three principal forms, material, mental, and "divine," but *he has no feeling of the broken paths that lead from the one to the other; no grasp of the value of the comparatively formless, of the process as distinguished from the result, of the sprouting as distinguished from the fruit*. Eccentric affections, pathos, tragedy, individuality, sublimity, are obscure to him. Yet his answer to Hobbes is essentially sound. His attitude is somewhat as follows: an animal must be selfish, but it must also be good to its own; man, as a moral being, who rejoices and suffers, thinks and feels, may be selfish, must be selfish, but the really human and natural type must sympathize with as much as he makes his own. If Hobbes replies, yes, but the motive is his own good in some sense at last, Shaftesbury rejoins that in the refined type the ideas of *meum* and *tuum* fade into a harmony through sympathy, and hence, selfishness, which is essentially a notion of opposition, division, and number, is completely overcome in a sense of family unity. There can be no selfish element in the contemplation of the universal beauty because that state of mind depends upon a sympathetic identification of the self with the whole world.

Common sense is accordingly the conception of a *disinterested humanity*, and this may be described as the form which the æsthetic *Anschauung* assumes in social relations. This is Shaftesbury's conception of *natural*, and gets strong support

¹ Cf. Faust I, "Erhalte dich und deinen Sinn
In einem ganz beschränkten Kreise."

from the consideration of the *impartial* attitude of the artistic mind in general, as, for example, that of Shakespeare, whose interest in humanity is at once free and intense. Common sense is the knack of living harmoniously in relation to the general surroundings, both material and moral, and the great literary character possesses this quality in the highest degree, though literary genius lacking in breadth is often conspicuously eccentric.

§ 7. PROPORTION IN CONDUCT.

Two points are clear from a general study of Shaftesbury's letters:¹ (1) That his style is more simple and intimate, less rhetorical than in his essays; and (2) that he is more severe in his condemnation of sensuality than he thought wise to say in his published utterances.² As a result of this greater sincerity we learn a little more about his ethics. The two chief points regarding morals, so far as we are concerned with his ethics in this treatment, are (1) that he recommends to Ainsworth as a rule of conduct the views of his own system, and (2) that he gathers the Nicomachean doctrine of the mean into a simple synoptical form in which all cases of conduct are reduced to four or five.

(1) His advice to Ainsworth may be summed up in the phrase, "Seek for the *καλόν* in everything!" This advice is given more specifically in the following forms: (a) In philosophy avoid extreme subtlety, and imitate rather the popular style and method of Locke; (b) In religion, be moderate, and above all be tolerant; (c) In literary style be simple and unaffected; (d) In reading be broad and impartial; (e) In the conduct of life be neither a sensualist nor yet a too unpractical idealist; (f) In social relations be neither selfish nor lacking in ambition, (g) Cultivate the body as a means of freeing the mind; (h) Avoid public controversy, but seek all means of self-criticism.

All this is summed up in the sentence, "Dwell with honesty, and beauty, and order; study and love what is of this kind, and in time you will know and love the author;" and in another place, "Seek and find out the true *pulchrum*, the *honestum*, the *καλόν*: by which standard and measure we may know God." Carefully proportioned striving is the rule of culture; this is beautiful conduct; the perception of divine beauty lies at the end of this vista; this is the highest good.

(2) In all his works (and particularly in the 8th letter of this series) Shaftesbury insists upon the sense of proportion as

¹The private letters.

²He desired to influence the 18th century society, not as a prophet, but as a man of the world.

instinctive or "connatural," and not derived from experience. He declares that the approval of beautiful form comes from an instinctive capacity, and is not learned. Like Plato and Aristotle he regards the form faculty as the essential mental principle. He admits that this may remain unconscious until an object is presented to the senses. He does not, like Kant, attempt to show the grades or steps that lead from the simplest forms in space and time to more complicated phenomena. He is interested not in metaphysics but in ethics, though his antagonism to Locke sometimes brings him near to epistemology.

Shaftesbury's idea of an ethical form may be resolved into five fundamental elements: (1) Egoism, (2) Altruism, (3) Sensuality, (4) Spirituality, (5) Proportion. The notion of proportion applied to a just balance between selfish and unselfish affections, runs all through his work. The notion of balance between the sensual and spiritual is found chiefly in these letters: (1) in the warnings against pleasure, sloth, intemperance and the sins of the flesh; and, (2) in the warning that there is a sort of spiritual ambition which unsuits a man for life, and lacks reality.

The most remarkable feature of his work here is that *he never falls into the ethical fallacy of confusing altruism with spirituality, or egoism with sensuality*, but takes these four as cardinal points of his form. Altruism and egoism are two elemental and equal forces in nature, they are the forms which instinct takes in the relations of individuals, and when refined by experience they combine again in spiritual power. When they are unequal in the individual the individual lacks balance, common sense, naturalness, (a bitch that eats her young is "unnatural"). Perfection requires two kinds of balance which one may designate as *lateral*, that is, between the contending forces of the parallelogram of social forces, namely, egoism and altruism, and *vertical*, that is between the animal appetites and the spiritual desires. We may connect this vertical balance with Plato's conception of the lower and higher souls, and with the Catholic denunciation of such sins as gluttony and sloth and adultery. But vertical balance is not more essential than lateral balance, and this conception aims at the sins of greed and ambition, and is the peculiar moral ideal of socialists, philanthropists, and the poor. An ethical form requires, then, the unification through harmonious proportion of (1) the animal lusts, (2) the spiritual aspirations, (3) the selfish, and (4) the unselfish affections.

With this simple conception of ethical form Shaftesbury unites the idea of *progress* through labor and study. Hence his conception of form leads to a conception of forms on various planes, the highest wheel touching the supersensible world.

The letters to Ainsworth in no way recommend heroism or martyrdom as a wise rule of life, but rather sense and tact.

§ 8. PROPORTION AND ART.

Shaftesbury spent his last days in Naples. He busied himself chiefly with the study of art. He made designs for pictures which he paid an artist to execute. Some of these are engraved in his works. *The Judgment of Hercules* is an essay on one of these. It is coldly allegorical. The didactic predominates over the aesthetic interest, and the piece is neither true to nature nor naively mythological or symbolical. Though not more distinctly allegorical and moral than many famous pictures, it quite lacks the fire and sincerity and technique that redeem works like Dürer's *Melencolia*, and Hogarth's *Rake's Progress*.

Shaftesbury's limitations in this field do not tend to prove that a fine sense for moral truth is not part of the equipment of a great artist, but rather that *such knowledge must be carried, so to speak, in the blood*, and not crystallized into maxims.

The picture in question is a kind of miniature of his whole view of life. Hercules is allured toward a pleasant glade by Venus and attracted toward a temple on a hill, toward which a steep road runs, by Minerva. Sensuality and selfishness draw downward and backward, and are opposed by spiritual ambitions and self-sacrifice. Yet Hercules is not less interesting to humanity because his will is determined only after a struggle.

Art, as Shaftesbury saw it, was a mirror of these great human passions and impulses, and beautiful because of the just proportions in which each type of character and situation is reflected. Beauty to him lay in the equilibrium of these warring elements. His views had influence upon the next generation of painters—the generation of Hogarth, Gainsborough, and Reynolds.

CONCLUSION.

This study, from an aesthetic point of view, leads in general to the submission of the following estimate of the chief points in Shaftesbury's ethics:

1. Proportion, symmetry and related aesthetic notions are applicable to moral phenomena.
2. These aesthetic notions depend upon the native structure of the mind, and constitute our moral sense.
3. Virtue consists in preserving a due proportion in the affections: it produces harmony and happiness.
4. The identification of selfish and social interests may occur on any of the planes of culture between animal and spiritual life.
5. The highest good is harmony on the highest plane of cul-

ture, consists in a pure enjoyment of the beauty of all nature, and demands stoical perfection.

6. The highest beauty is sublime and beautiful at once.
7. Evil may be seen to be imaginary by a retreat of the consciousness into the place of an aesthetic bystander.

8. Enthusiasm is genius or fanaticism according to its proportions.

9. "Natural" means symmetrical in relation to egoism and altruism, on whatever level of culture. Common-sense is nature on a middle level.

10. Literature demands self-knowledge through observation and sympathy.

11. The beauty of art depends on a harmonious equilibrium of contradictory (moral) elements.

The striking defect of Shaftesbury's exoteric ethics is not any exaggeration of the value of aesthetic form, but a lack of recognition of those evolutionary activities which oppose form and destroy harmony on one level to lead to form and harmony on a higher level: as, in art and literature, tragic earnestness attacking unsolved problems of conduct and fate; in religion, a certain fanaticism; in morality, self-sacrifice; in learning, specialism; in conduct, martyrdom; and, in general, eccentric and solitary activities. He understood *adequate* but not *provisional* forms.

A GENETIC STUDY OF RHYTHM.

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CHAPTER I. PROBLEM AND METHODS.

§ I. *Problem Stated and Defined.*

One of the most recent writers on rhythm¹ has affirmed that "Es gibt keinen schlechten Rhythmus." In other words, the perception of rhythm is present in completeness or vanishes entirely. This appears to be the opinion of the majority who have discussed rhythm,—either actually expressed, or implicit in their general presuppositions. But are there not well marked stages of relative perfection and complexity in the perception and production of rhythm?

The present Study is an investigation of this question with respect to one field of motor rhythm, that of rhythmical speech. Are all rhythmical forms equally simple psychologically; can the trochee and iambus, for instance, be regarded as equally difficult? Moreover, is any one verse-form constant and unalterable in structure; does it not also show different degrees of completeness and unitariness? *E. g.*, is the dactyl as produced by the young child as complex in structure as that produced by an older child; do the same objective variants appear in both cases; and do they bear the same relations to each other? Or, again, to put the question more concisely; can a correlation be made out between growth in complexity of the rhythmical form produced and mental grasp the producing subject?

There has been no attempt in what follows to bring the stages of this progressive growth in complexity of structure into connection with the history of the different metrical forms; for, in the first place, psychology has no concern with metrical questions as such; and, secondly, we have no more right to argue from the present psychological data back to an hypothetical past consciousness, than from that past to the present. Factors unknown to the present consciousness were undoubtedly effective in the past; and such factors would naturally vitiate any deductions drawn.

In the investigation of our main problem other questions arose, which seemed to demand special attention. These have been separately treated. They are: (1) the nature of pitch as an objective determinant of rhythm; its direction and constancy as compared with that of the temporal and intensive factors; (2) the relation of breathing to the spoken rhythm; (3) the conditions under which concomitant movements appear; and (4) the influence of chorus reading upon tempo,—a comparison of chorus-time with the average times of the individuals.

The present Study cannot be termed genetic in accordance

¹ *Rhythmus und Arbeit*, Margaret Kiever Smith. Phil. Stud., XVI, p. 292.

with the usual signification of that term, which emphasizes the concept of origins. But it is genetic in a secondary or derived sense; for it seeks to determine the essential constituents of rhythm, and the variations they undergo in the development of the more complex from the simpler forms.

The genetic theories have been chiefly concerned to explain the origin of rhythm. They have been content, as Meumann¹ justly says, to furnish an opportunity for the entrance of the rhythmic consciousness, but have made no attempt to analyze the psychological and physiological mechanism of this consciousness; all this they have taken for granted.

Such theories have, as a rule, relegated the working of the causal principle to the remote past. Hence they are not only safely entrenched against the criticism which experimental and introspective facts might seem to warrant; but they are also unable to appeal to introspection or experiment for support. Consequently, genetic theories of this type must depend upon historical data for their verification. Even when connected with metrical investigations they can never have greater weight than that which is accorded to speculative hypothesis. Even the recent interesting investigation of Bücher has the defects common to genetic theories² of the type mentioned.

The genetic method, as it is here used, has its chief value in the solution of the problems offered by the psychological complexes themselves. Rhythm, for the adult consciousness, is so interwoven with associations of all sorts; is such an unitary and unanalyzable experience; that it is well nigh impossible to disentangle the essential from the non-essential constituents. But we can hope, through a judicious use of the genetic method, to reach a more satisfactory analysis of the objective constituents,—temporal, intensive and qualitative—and of their relations to each other; by correlating these with increase in ability to attend and to apperceive we can also hope to show more clearly the intrinsic nature of rhythm.

The danger of false interpretation of such data is greater than it is in the case of adult psychology. This is due to the tendency of all observers to read their own experience into the observed phenomena. The experience of an observer is naturally farther removed from the child's than from that of another adult. Neither can observations in this case be verified by the introspective report of the subject, as in the problems of adult psychology. But with carefully collected data, and conservative interpretation, the danger can, we think, be reduced to a

¹ *Untersuchungen zur Psych. u. Ästhetik des Rhythmus, Phil. Stud.*, X, p. 252.

² *Arbeit und Rhythmus, Zweite Aufl.*, Leipzig, 1899.

minimum. The investigation of Bolton¹ sought in another way, *i. e.*, by the study of subjective rhythmisation, to reduce the problem of the psychological constituents of rhythm to its simplest terms. While this method gives us the simplest conditions under which grouping may occur, it cannot show the relation of the simple or subjectively conditioned rhythm to the more complex and objectively conditioned.

§ 2. METHOD.

The age of the subjects—children of the first, fourth and seventh grades—determined the method. It was necessarily objective,—a study of their ability to produce the different rhythmical forms.

Those who have worked with children know that the normal child is incapable of introspection. Even if an occasional child might be able to give introspective data, these would have slight scientific value; for every sign is caught at, as a suggestion in accordance with which a report may be given. The answers returned to the simple question of 'what form pleased them most' were contradictory in so many cases, that from the answers given by sixty children at several different readings not enough reliable material was obtained to base a single conclusion upon.

The investigation has been confined to the spoken rhythm. It was desired later to test children of the same age on the ability to tap the same forms. The time, however, failed for this, except in the case of several particularly unrhythmical subjects. Thus a satisfactory comparison of the two forms of motor rhythm, which would be highly desirable, cannot be made. The experiment was performed in two ways. (1) A successive number of readings were given by a comparatively large number of children. An analysis was made by the experimenter during and immediately after the production of each form. (2) The same forms were given by three children; a girl of seven, and two boys of nine and eleven respectively, and the Rousset-Lot microphone was used for analysis. The first series of tests was made on both German and American children; the second on American alone.

Method I. The children serving as subjects were taken from the Zentral-Schule and Sanderschule of Wuerzburg, and the Central and Grammar Schools of Ithaca. They were on the whole normal children, neither exceptionally bright nor exceptionally dull. The teachers were requested to select five boys and five girls from each of the three grades before mentioned. They were to give, in their selection, as great variety of temperament as their school afforded,—the plodding and faithful student as well as the careless and listless,—but were

¹ Rhythm, *Amer. Jour. of Psych.*, VI.

to except any who might be abnormally dull. By such selection we hoped to obtain results that might serve as typical. The children entered into the experiment with a zest that had hardly been expected. The syllable *mi* for the German children, *me* for the English, was written in five lines of six syllables each; care was taken to keep the syllables of the same line equidistant. The experiment was carried on in a room separated from the class room. The children were admitted singly, in order to avoid the influence of one upon another. They stood during the experiment; the paper being placed so that, as the child stood in a comfortable position for reading, he was also in a good position for the experimenter to note all concomitant movements. A position directly at the side of the experimenter was found to be the most favorable. The children were first requested to read the lines in the manner that seemed most natural to them. The purpose of the free reading was to determine whether on the motor side a subjective grouping would appear such as that already noted by Bolton¹ on the sensory; and, if so, under what conditions. Miss Smith² has since noted such grouping in her investigation at Zurich: the present investigation was begun before this appeared.

The children were later asked to emphasize particular syllables, thus throwing the whole into certain rhythmical patterns. Every expression which might influence them as to the manner of emphasis was carefully avoided, as one of the questions to be investigated was the nature of emphasis or accent and its psychological meaning. The forms required were (*a*) the first emphasized; then every other one; (*b*) the second, then every other one; (*c*) the first, and every third following; (*d*) the third, and every third following that. The order in which these directions were given was continually varied, in order to avoid the favoring by practice of any one or more forms. The time, intensity and qualitative differences were noted by the experimenter, together with any other facts, such as movement or breathing, which might bear upon the investigation as a whole; and the time occupied by the reading of the series of thirty syllables was taken with a stop-watch. A single syllable was repeated, in order to get material which was not already rhythmically ordered, as we desired to find what must be added to a series of disconnected sensations in order to make

¹ *Op. cit.*, pp. 203 ff.

² *Op. cit.*, p. 282. "Es gibt also ebenso einen Zwang zu motorischer Rhythmisirung fortgesetzter Bewegungen wie zum subjectiven Rhythmisiren von Schalleindrücken die in gleichen kurzen Zeiten aufeinanderfolgen." In one case, where the subject failed to raise the weights *regularly*, there was no perception of rhythm. Subjects when asked to read staccato broke the series into groups of four or six syllables.

it a rhythmical whole as well as to see if any one form of grouping appeared more frequently than others. Consequently, words which already possess a primary rhythm, and verse with its complicated rhythms, could not be used. It was also necessary to employ the *same* syllable, in order to avoid all inequalities in the articulation.

It might be objected that deductions cannot be made from the grouping of such material as this to the grouping of verse. To this it may be replied that, in so far as the primary rhythm governs verse, the same principles hold as in the grouping of these simple meaningless elements. It is the modifications introduced by what Sidney Lanier¹ terms secondary and tertiary rhythm, *i. e.*, the rhythms of word-accent and thought, that change the primary rhythm, giving verse its special beauty and flexibility. Moreover, in the experiment with the American children of the fourth and seventh grades, the syllables were frequently involuntarily modified so as to read *meet me*, *me*, or *meet me*, thus introducing a secondary rhythm.

Method II. From the American children, subjects were chosen who had taken part in the previous experiment. The method was modified by using the Rousselot microphone. The record of the rhythm was traced on the drum of a Ludwig-Baltzar kymograph; synchronously a breathing curve was registered. For this the Harvard pneumograph, adjusted around the chest, was connected with a Marey tambour. The time was marked in fifths of a second by a Jaquet chronometer. The Rousselot microphone consists of a metallic mouthpiece connected by a rubber tube with a cylindrical metallic box in which three carbon tips are suspended. The adjustment is made by means of a screw at the end of the box opposite the junction with the tube. The screw, through its connection with a metallic spring to which one of the carbon tips is attached, regulates the distance between the tips. The wires connecting the tips with the electrical circuit enter through the top of the box. In the same circuit is a small electro-magnet, above which is a drumhead of goldbeater's skin, to which is attached a writing point. The changes in the current of air entering through the tube make and break the current. The intensity of the sound is indicated by the amplitude of vibration of the writing point; the pitch by the number of vibrations in a given unit of time; the duration of syllables and pauses by the length of the records and the length of the intervals. It was found necessary to use a more explosive syllable than *me*, and *be* was substituted as being nearly equal in time. The microphone responded with the greatest precision when the level of the

¹ The Science of English Verse, N. Y., 1888.

mouthpiece was slightly below the mouth of the child. The children stood as before. The number of syllables was not limited, as in the previous experiment. All of the involuntary series were taken first, then the complex groupings in varied orders. Though the microphone responded as readily as could be expected, the restrictions of position, etc., decreased the child's sense of freedom; concomitant movements were very seldom marked, while none of the zest that had been shown in the previous experiment was observed. Each method had its peculiar advantages and disadvantages. The chief advantage of the second was that it furnished an accurate record of the rhythm as it was given. The disadvantages were that with fewer children there was less variety in form, and that individual characteristics might easily be confused with general. The feeling of restraint that attended the use of the microphone could not be eliminated, and militated against a natural grouping. The experiment was regarded as a task, while in the earlier experiment the children gave themselves up freely to the swing of the rhythm. As already shown, the first method had the advantages of a freer rendering on the part of the children and greater possibilities for variety in form; its disadvantage was that, as we possessed no objective control, there was liability of error in the analysis of the experimenter. But this liability to error in analysis was counterbalanced, in a measure at least, by the facts that for many of the series two experimenters were present, and that a large number of observations were made. The second method, then, can be considered as a control of or check upon the first.

CHAPTER II. RESULTS.

§ 1. *Involuntary Grouping.*

Results from Method I. The series were separated by intervals of a week. The first series were given before the children had learned the complex forms; but the practice of the previous week had doubtless some influence upon the succeeding series; this reached its height in the third series. Later, probably because of the monotony of the work, there was a return to the simpler forms of the first series. The order of succession, regularity or irregularity in the occurrence of a pause, is the primary objective determinant. A four group form divided into twos occurred twice; and $\dot{\text{p}}\text{p}\text{p}$ | $\dot{\text{p}}\text{p}\text{p}$ was noted once; otherwise, with the exception $\dot{\text{p}}\text{p}\text{p}$ | $\dot{\text{p}}\text{p}\text{p}$ that the end of the line was frequently marked by a longer pause and a falling voice, the three-grouping was the largest observed. We will note first those cases, in which the syllables varied neither in time, intensity nor pitch, although differentiated by the regu-

lar or irregular occurrence of a pause. The results can be tabulated under four rubrics: (a) no observable regularity in the occurrence of a pause; (b) pauses after each syllable of equal duration; (c) pause after every second syllable noticeably longer than the intervening; (d) the longest pause after every third syllable.

TABLE I.

Irregular pauses.			After each syllable.			After every 2nd.			After every 3rd.			
Gr. I.	Gr. IV.	Gr. VII.	Gr. I.	Gr. IV.	Gr. VII.	Gr. I.	Gr. IV.	Gr. VII.	Gr. I.	Gr. IV.	Gr. VII.	
2	4	6	9	3	9	0	2	2	0	0	0	G. B.
19	18	23	19	18	22	19	18	22	19	18	23	
2	3	5	2	0	0	0	1	23	0	0	0	
15	20	25	15	20	25	15	20	25	15	20	25	G. G.
3	5	0	3	6	2	7	2	2	1	1	0	
22	22	18	22	22	18	22	22	18	22	22	18	
4	1	0	0	4	3	6	7	5	1	3	1	A. B.
22	22	19	22	22	19	22	22	22	22	22	19	
												A. G.

G. B. indicates German boys, G. G. German girls, A. B. American boys, A. G. American girls. It was impossible to obtain exactly the same number of readings from each class; for, on the appointed day, one or even two of the five children might be absent, and nothing remained but to proceed with the experiment: hence the results are given in fractional form, the numerator representing the number of occurrences, the denominator the total number of readings.

In the first case all perception of rhythm failed, although the rate of reading was sufficiently rapid for rhythmical grouping to have occurred. The irregular cases are distributed through all the five series. Had the irregularities been due to a difficulty in the articulation of the syllables, we should naturally expect that practice would cause its disappearance in the later series. Another peculiar fact is that the number of irregular cases is greater among the upper grades of the German children than among the lower. This, in the light of the fact that movements regularly repeated tend to become automatic, would seem to show that the irregularities in this case cannot be explained on the ground of irregularities in motor adjustment. The most plausible explanation is that the series did

not possess sufficient interest to hold the attention, and that the irregularities in the rhythm were due to the irregular pulses of attention.

In case (*b*) we have what Miss Smith terms "einfachen" or "Urrhythmus." "Es ist keine Frage dass auch in der blossen Aneinanderreihung von völlig gleichbetonten Silben, zwischen denen keinerlei Gruppierung mehr hergestellt wird, ein Rhythmus liegen kann. Ebenso kann eine Zeile eines Liedes in lauter ganz gleichen Noten voranschreiten, und doch rhythmisch sein. Diesen Fall bezeichnet die Verfasserin als einfachen oder Urrhythmus."¹ This Lanier calls "primary rhythm."² "If equal or simply proportioned intervals of time be marked off to any of our senses by any recurrent series of similar events, we may be said to perceive a primary rhythm through that sense." "But this primary rhythm may be considered a sort of primordial material, which the rhythmic sense of man always tends to mould into a more definite, more strongly marked, and more complex form that may well be called secondary rhythm."

There is no apparent correlation between age and the appearance of this form in the free reading. The cases are fairly equally distributed among the grades. The pronunciation of each syllable was frequently accompanied by a forward movement of the head or of the whole trunk. With the first grade children, when attempting to produce an anapaestic or dactylic form, a lapse into the primary or uncompounded rhythm was often noted. A frequent peculiarity of such cases was a regularly recurring pitch, time, or intensive difference, together with pauses of equal duration at the end of each syllable. It was doubtless due to a breaking down of the complex group in which certain characteristics of the complex form were still retained. These cases throw light on the mental processes underlying rhythm. The most plausible explanation of the phenomenon seems to be that one wave of attention did not take in the total group, so that each single syllable was the object of one act of attention. Although the different syllables were still compared as to time, intensity, etc., it was a mediated comparison of the same nature as that performed by the adult in his comparison of the several groups of a long series. This transition from immediate to mediate comparison could have been brought about either by the slow rate of succession, or by the too great span of the group as to number, or by the intrinsic difficulty of making a comparison; any one of

¹ *Op. cit.*, p. 198.

² *Op. cit.*, p. 62.

these three factors would have brought about the result. Wundt¹ denies that this alternate series of syllable and pause, movement and rest, attention and inattention constitutes a rhythm. "Gleiche Eindruecke in gleichen Pausen stattfindend wirken ermuedend, aber niemals rhythmisch. Damit ein æsthetisches Gefallen entstehe, muessen mindestens zwei verschiedene Eindrücke, Hebung und Senkung des Klangs, wie in 2/8 Takt, in regelmaessigem Wechsel einander folgen, mag nun dieser Wechsel durch die Eindrücke selbst oder bloss durch die subjective Betonung erzeugt werden." In this passage, the term 'rhythrical' clearly connotes capability of arousing an æsthetic feeling. This seems to be an unwarrantable limitation of meaning. If æsthetic value is to be made a criterion of rhythm, then frequently the complex forms must be regarded as unrhythrical; for there are not a few instances in our own experiments, as well as in those of others, in which a form possessing all the objective marks of a highly complex rhythm and evidently perceived as such was either subjectively indifferent or positively unpleasant. The feeling of æsthetic pleasure is too subjective a criterion to apply to such an objective and universal fact as that of rhythm. In the present paper, rhythm is used to cover all cases of regularly recurring impressions derived from the modalities of audition and movement.

The first step toward an unification of the separate impressions is that noted in cases (c) and (d). Here two or three syllables of equal duration, pitch and intensity, are separated from those following by intervals noticeably longer than the intervals between the given syllables. This form was characteristic of the free reading of the seventh grade boy by Method II; cf. record for Charles, Method II, involuntary grouping. It scarcely appeared in the reading of the German children. When there was a rhythm, there was generally a subordination of one syllable to another, by means of pitch, intensity, time, or a combination of these. The form shown in case (d) was far less frequent than that of case (c). Many of Bolton's² subjects found difficulty in throwing auditory sensations into groups of three; our own (cf. results on pitch) never grouped in threes unless there was an objective ground for so doing. The form shown in case (c) frequently resulted when the younger children attempted to give the more complex rhythms. This form was also characteristic of the free readings of the two negro children, a boy of the first and a girl of the fourth grade. For the hearer, their reading was very rhythmical. The time values

¹Grundzüge der physiologischen Psychologie, 4e Aufl., 1893, II, p. 237.
²Op. cit., p. 216.

for these series were greater than those for the irregular and the primary forms. We may presume, then, that the syllables were given their original length, and that the interval between successive pairs was considerably lengthened. One wave of attention could compass the group, and no attempt was made to compare syllable with syllable. These results do not tally with the generally accepted rule for the subjective grouping of auditory sensations, which affirms that there is no tendency to group successive sounds until some one is heard as more intensive than the others. Have we here a purely physiological phenomenon, which has no parallel in sensation; in other words, is such a series perceived as rhythm, or is there merely a rhythm in the motor mechanism? The result might have been the outward expression of the natural breathing rhythm, the expiration lasting during the two syllables and the intervening pause; but such a curve, as will be seen in the discussion of breathing, is not the normal rhythm of respiration. There is another possible explanation. It is that, although the syllables presented equal difficulties for the organs of articulation, etc., and there was nothing in the nature of the syllables themselves or the child's attitude towards them to raise one in importance above another, there was, nevertheless, a tendency present towards the unification of the large number of separate syllables, by their division into a number of smaller groups. Several syllables fell within one pulse of attention, and the pause which corresponded to the zero-point of the attention wave was consequently longer than the intervening pause. Meumann and Bolton dealt only with the grouping of auditory sensations. Doubtless in that fact is to be found a partial explanation of the disagreement in results; still (*cf.* the section on pitch) subjects frequently broke up series of equal sounds into groups of two, four, six, eight, etc., syllables, without giving any one more intensity, duration or pitch than other. There was, according to their statement, no recurring intensive difference to cause the grouping for the perceiving subjects. These cases were interspersed among series that differed objectively. The conditions here would seem, then, to be more favorable for a correct analysis of the perception of rhythm than they were in the experiments of Bolton. For here the series which had no objective mark of difference lost in subjective intensity in contrast with objectively conditioned rhythm.¹

The breaking up of the series of separate impressions into groups of two or three equally accented syllables was an ad-

¹ One of Miss Smith's subjects found in learning nonsense syllables that "der Rhythmus der Betonung spielte keine so grosse Rolle wie Gruppierung oder Theilungen." See *op. cit.*, p. 256.

vance upon the primary rhythm; but the group lacked unity. The manner in which a closer grouping was effected varied with the individuals, and there were also indications of race difference; but regular temporal, intensive, and qualitative variations were the objective factors. The longer, higher and louder tones occurred together or were used interchangeably. Meumann discusses the interchangeability of time and intensity in the estimation of time intervals under the principle of "Stellvertretung."¹¹ The accent, intensive, temporal or qualitative, was given as shown in the Table. Accent is used throughout as synonymous with emphasis, and is not restricted to increase in intensity.

TABLE II.

Qualitative.			Intensive.			Temporal.			G. B.
Gr. I.	Gr. IV.	Gr. VII.	0	2	1	1	1	2	G. B.
6	9	3	19	18	23	19	18	23	
19	18	23	0	5	5	0	6	6	G. G.
10	16	15	15	20	25	15	20	25	
15	20	25	3	7	6	5	5	5	A. B.
2	3	2	22	22	18	22	22	18	
22	22	18	5	2	1	3	6	5	A. G.
5	2	1	22	22	19	22	22	19	
22	22	19							

G. B. indicates German boys, G. G. German girls, A. B. American boys, A. G. American girls. The numerators give the number of occurrences, the denominators the total number of readings.

The most noticeable fact shown by the Table is the greater number of cases of qualitative accent among the German children. The pitch intervals were also as a rule greater than with the American children. The number of accented readings, intensive, temporal and qualitative, was greater among the German girls than among the German boys. Both American boys and girls of the seventh grade gave accented readings more frequently than the German boys of the same grade. There were a greater number of irregular readings given by the German boys of the seventh grade than by the younger children.

¹ Beiträge zur Psychologie des Zeitbewusstseins. Phil. Stud., IX, pp. 303 ff.

Cf. with this result, Table I, above. There seems to be a curious contradiction here. Other things being equal, the irregular readings disappeared with increased age, and one might reasonably expect to find an increased tendency to accented grouping among the older boys; but the explanation given in the account of irregular readings doubtless holds here.

It is a question how much a conscious imitation of the complex forms had to do with the manner of free reading. We discovered it in the case of one of the American boys of the seventh grade. When questioned he admitted that he was purposely giving a certain form because it pleased him. Even after throwing out such cases, which were not frequent,—knowing the characteristics of children, we were able to detect any such distortions,—there is a noticeably greater tendency toward a strongly accented rhythm in the free readings given by the older children than in those given by the first grade. The first syllable was almost invariably the accented syllable; the reverse occurred but three times among the American children and twelve times among the German.

Results from Method II. To avoid the influence of the complex forms upon the natural grouping, all the involuntary series were taken first. This order would have been followed in the first instance; but the children would then have taken no interest in what, from their point of view, would have been a stupid and meaningless task. For this reason it was necessary to ask for the restrained and free readings on the same day. But the microphone presented difficulties enough to make the desirable arrangement possible, and yet preserve the interest of the children. On the other hand, the use of the microphone was too difficult to be accompanied with much pleasure.

R. A. Girl, first grade, self-controlled to an unusual degree, susceptible to rhythm. The figures given are the averages of the absolute time values of the successive series. Pitch was uniform throughout, and the intensities varied but slightly, and only in the manner indicated in the Table. Type of grouping was clearly primary, uncompounded, occasionally irregular. Series (3) will be discussed in detail as it has an important bearing on the genesis of the complex rhythm.

We note that the time of both syllable and pause falls within the most favorable time for rhythmical grouping (.5 to .2 second). The grouping falls under either the irregular or the primary type, with the exception of Series (3). The breathing record is interesting in this connection. Each syllable corresponds to an expiration, each pause to an inspiration; *i. e.*, a full inspiration was taken after every syllable. (*Cf.* breathing records.) This type of breathing was characteristic of *R. A.*'s reading, restrained as well as free.

TABLE III.

	Syllable.	Pause.	Intensity and Pitch.
Av. values for series in sec.	(1) .408	.458	No variations in pitch or intensity.
	(2) .298	.454	Intensities of the syllables equal; each syllable begins with greater intensity and then gradually grows less; no variation in pitch.
	(3) .282	.346	Important for genesis of rhythm. Cf. discussion following.
	(4) .463	.39	No variations in intensity or pitch.
	(5) .287	.45	" " " " " "
	(6) .332	.4	" " " " " "

Series (3) was taken on the same day as (1) and (2); the microphone was working unusually well. *R. A.* began with the primary form; suddenly we heard a marked change in her manner of reading. It was trochaic. Nothing that we could observe had occurred to bring about the change. We could only refer it to the ease with which she was reading, and the practice that series (1) and (2) had given her; although in the free readings following she never reverted to this type. It is also to be noted that at the same time in which the rhythm became trochaic the breathing curve was compounded; *i. e.*, expiration lasted during the interval occupied by two syllables and the intervening pause. The complete results are given for this series. The breathing record is paralleled with that for the spoken rhythm. The variations of amplitude of vibration within the rhythmical unit at no time exceeded 1 mm.; therefore only the relative deviations in intensity can be given.

It is probable, had it been possible to make the estimations perfectly exact, that the slight deviation between the time for the breathing and the spoken rhythm would disappear. It is to be noticed that compounding in breathing occurs before there is any evidence of a grouping in the spoken rhythm, but that immediately thereafter the second syllable becomes shorter and less intensive than the first, although the intervening pause is fully as long as that following. Next, the second syllable is shortened and the pause following it is lengthened. This markedly trochaic grouping lasts in its most perfect form, as shown in the * groups, for only three groups; following upon this, there is either no difference in the length of the pauses, or an unvarying intensity, *i. e.*, a less perfect grouping. While we cannot conclude from this one record that it presents the exact order in which a complex grouping is brought about, it clearly gives a possible genesis, and shows how closely related breathing and grouping are. There is no evidence as to which

TABLE IV.

Breathing Record.			Spoken Rhythm.		Pitch and Intensity.
Exp. sec.	Insp. sec.	Height mm.	Syll. sec.	Pause sec.	
.419	.233	1.5	.35	.337	
.466	.166	2	.325	.35	
.5	.266	2	.3	.325	
.5	.33	2	.3	.4	
.466	.266	1.5	.375	.325	
.6	.233	1.3	.45	.275	
.4	.283	3	.325	.4	
.466	.33	2	.275	.325	
1.566	.33	2	{ .325 (a) .35 (b)	.4	
.966	.45	2.25	{ .3 (a) .125 (b)	.35	
1.016	.316	.266	{ .425 (a) .125 (b)	.325 .175*	" " " " "
1.66	.316	2	{ .4 (a) .25 (b)	.175* .4	" " " " "
I	.316	2.25	{ .35 (a) .225 (b)	.275* .4	" " " " "
.95	.35	2.75	{ .25 (a) .15 (b)	.375 .5	" " " " "
1.03	.266	2.5	{ .25 (a) .225 (b)	.35 .425	" " " greater than that of (a).
I	.283	2.75	{ .375 (a) .175 (b)	.275 .45	" " " equal to " " "
1.16	.3	3	{ .25 (a) .175 (b)	.35 .215	" " " less than " " "
I	.3	3	{ .45 (a) .2 (b)	.175 .425	" " " equal to " " "
I	.316	2.25	{ .5 (a) .2 (b)	.175 .425	" " " " "
.85	.33	2.33	{ .375 (a) .2 (b)	.2 .4	" " " " "

stands in the relation of cause and which of effect unless priority of compound breathing might be taken as an indication that change in breathing was the cause of the grouping. It is more probable that the change in breathing was due to some psychical factor which may in turn, enforced by the breathing, have brought about the decided grouping. The state of *R. A.* at the time of the record was evidently one of pleasurable interest in a not too difficult activity. There was a pendular movement of the whole body, such as was seldom marked in the experiments with the microphone, although found very frequently in the readings given by Method I. One might venture, then, to posit as a cause for the grouping the fact that the attention was directed upon the series as a whole and not upon the articulation of each separate syllable.

H., a boy of ten, fourth grade; restless and incorrigible in school; while interested in the experiments, was unable to direct his attention long upon any one thing. (The first three series of the free readings were given by a boy of another type; but he was not available later, and *H.* came to the laboratory in his place.)

TABLE V.

	Syllable.	Pause.	Pitch and Intensity.
Av. values for series in sec.	(1) .588	.136	No variation in pitch or intensity.
	(2) .363	.13	
	(3) .573	.175	
	(4) .35	.276	
	(5) .442	.191	
	(6) .488	.173	
	(7) .402	.192	

The pauses are invariably shorter than in the reading of *R. A.* The relative times have changed. While in *R. A.*'s reading the syllable and pause varied but slightly in duration, in the reading of *H.* the pause is much shorter. There is scarcely any variation in the duration of the several pauses. The rhythm is throughout of the purely primary type.

The breathing was very different from that of *R. A.*; an expiration lasted on an average for eight syllables, although as few as five and as many as ten were at times included in one expiration. The inspiration was short, corresponding to the longer pause in the spoken rhythm. The grouping was also of the same general form; series of five to ten syllables, varying very slightly as to time and not at all as to intensity or pitch, were separated by short pauses and followed by a longer pause, varying in length from .3 to .5 second.

C. D.; eleven; seventh grade; leads his class; very painstaking.

TABLE VI (a).
Primary Rhythm.

	Syllable.	Pause.	Pitch and Intensity.
Av. values for series in sec.	(2) .57	.158	No variations in pitch or intensity.
	(3) .548	.142	
	(7) .75	.137	

TABLE VI (b).
Two Grouped Rhythm.

Syllable.	Pause.	Pitch and Intensity.
(1) (a) .59	.084	
(b) .56	.163	
(5) (a) .565	.1	
(b) .532	.181	
(6) (a) .7	.102	No variations in pitch or intensity.
(b) .69	.221	
(7) (a) .555	.075	
(b) .495	.138	

The breathing was of the type already mentioned in the case of *H.* There were none of the irregular fluctuations which appeared in *H.*'s reading. While pitch and intensity held the same throughout the series, there was a slight tendency to a two-grouping in series (1), (5), (6) and (7). In these series the first syllable of the group was slightly lengthened, as was also the pause at the end of the second syllable; *i. e.*, they approached the trochaic type. In the other series, the larger groups which corresponded to the breathing rhythm were made up of an irregular number of syllables, seven, nine, or eleven. The separate syllables varied but slightly in duration. They were examples of the primary rhythm. On the whole, *C. D.* shows a greater tendency to rhythmical grouping in his free reading than does either *H.* or *R. A.* of grades four and one.

It is apparent at a glance that the results gained by Method I gave a greater variety in manner of grouping; pitch and intensive differences were there frequently present, whereas here they fail entirely, except in series (3) for *R. A.*, which showed slight intensive variations.

The reason for the disparity between the results of the first and second method can be accounted for as follows. (a) The practice with the restrained or complex groupings exerted an influence on the free readings of the succeeding week, in the first experiment; (b) with the microphone, there was a certain constant resistance to be overcome; this tended to bring about an automatic regularity and uniformity in the articulation of the syllables, and the result was the primary form; (c) the resistance of the microphone was so great that attention was directed upon the articulation of the syllables. The freedom and spontaneity that characterized the readings, as given by Method I, were entirely wanting. This would militate against the perception of rhythm. Miss Smith points out similar in-

stances.¹ "Obgleich (beim einfachen Rhythmus) in diesen Versuchen die Bewegungen des Aussprechens taktmaessig waren, hat die Versuchsperson wegen der Schwierigkeit desselben keinen Rhythmus irgend welcher Art empfunden. Die ganze Aufmerksamkeit wurde auf die Qualitaet der Leistung gerichtet, und wie vorher bei den Gewichts-und Schreibversuchen entstand auch hier die Empfindung des Rhythmus erst dann, wenn eine gewisse Gewandtheit gewonnen worden war."

(d) According to the arrangement of Method I, the syllables were written in five lines of six syllables each. As they thus stood, they were more readily divided into groups. One of Miss Smith's subjects reported that, as he readily divided a visual series into groups of three, so three syllables made for him an unity easily perceived. This may also have been a factor which helped to bring about the divergences in the results of our two Methods.

Summary.

1. An involuntary grouping may arise either through a regular variation in time relations, or by regular intensive or qualitative variations. The earliest form, in order of priority, seems to be the primary; following that is the two-grouping with equal syllables, but regular variations in the duration of the pauses; then comes the two-grouping by means of temporal, intensive or qualitative subordinations among the syllables.
2. The temporal subordinations are the first to appear in involuntary grouping; intensive or qualitative changes come later.
3. Grouping increases in completeness with increased development of the child.
4. There seems to be a tendency in the motor mechanism toward automatic regularity which furthers the production of rhythm.
5. Breathing appears to stand in a functional relation to the rhythm.
6. Involuntary grouping occurs (a) when the attention is directed upon the series as a whole; (b) when an incentive is present to lighten the work of perception by separating the total series into smaller and easily perceived groups. This equal division of attention (in pulses of natural length) gives the double guarantee of a perception of all the members of the series with a lightening of the work of perception.
- (c) When a regularly recurring activity tends to bring about a rhythm in the motor mechanism;
- (d) when there is no feeling of bodily discomfort or strain to distract the attention.
7. Grouping disappears (a) when the effort of articulation is so great that attention is necessarily directed upon the act itself; when, *i. e.*, the attention is abstracted from the succession to the individual members; and (b) when the time equivalent to the normal pulse of attention is exceeded by the total duration of two syllables.

¹ *Op. cit.*, pp. 233, 254, 290.

§ 2. VOLUNTARY GROUPINGS.

For the sake of convenience, the results are given in the order: trochaic, iambic, dactylic, anapæstic groupings, although, as before stated, the order was constantly varied during the course of the experiment. The terms trochaic, iambic, dactylic and anapæstic are not used in the metrical sense, but as convenient terms for forms of restrained groupings of two and three syllables, in which a certain syllable of each group is emphasized. Grouping was, however, never mentioned; it arose naturally and involuntarily from the regularly recurring emphasis.

Method I. As in the free readings, the judgments of the experimenter were only relative; *i. e.*, one syllable was judged longer or louder than another. We attempted to note pitch differences exactly. While it would have been desirable to note time and intensity differences under the three categories of just noticeably present, present, and marked, we found that the distinctions had not been and could not be accurately enough made, in every case, to warrant such a classification. Notice was also taken of the position and character of the pause, the presence or absence of concomitant movements and their general character, together with the time for the whole series. The concomitant movements and time values of the different forms are discussed in a later Section.

Because of the unequal number of readings in the different classes, Tables of presence and of absence have been given. The distinctive differences in the readings of the three grades are clearly brought out by a comparison of these two Tables. In the case of qualitative differences, 'marked' designates intervals of a fourth or more; 'inverted' signifies that the falling inflection occurred, where the rising is ordinarily given, or *vice versa*, or that the relations of long and short were reversed, etc.

Total for Five Series of Trochaic Readings.

TABLE VII (a).
Pitch Variations. (Present.)

I.	IV.	VII.	
15 p. 3 m. 1 i. 0 ir.	10 p. 7 m. 0 i. 1 ir.	10 p. 10 m. 1 i. 2 ir.	G. B.
17 p. 0 m. 0 i. 1 ir.	10 p. 9 m. 3 i. 0 ir.	17 p. 3 m. 3 i. 0 ir.	G. G.
4 p. 0 m. 1 i. 0 ir.	12 p. 2 m. 0 i. 0 ir.	12 p. 2 m. 0 i. 0 ir.	A. B.
7 p. 1 m. 1 i. 0 ir.	16 p. 2 m. 0 i. 0 ir.	13 p. 0 m. 2 i. 0 ir.	A. G.
43 p. 4 m. 3 i. 1 ir.	48 p. 20 m. 3 i. 1 ir.	52 p. 17 m. 6 i. 2 ir.	Total.

p., signifies present; m., marked; i., inverted; ir., irregular.

TABLE VII (b).
Pitch Variations. (Absent.)

I.	IV.	VII.	
0	1	1	G. B.
1	1	2	G. G.
16	8	4	A. B.
14	3	4	A. G.
31	13	11	Total.

(1) The tendency of the German children toward a qualitatively determined rhythm is shown more clearly in the Table of absence than in that of presence; but this difference between the German and American children decreases with increasing age. (2) Intervals of a fourth or more occur more frequently among the German children. (3) Cases of inversion were scattered through all the series; the voice-fall being falling-rising, instead of rising-falling, as generally found in trochaic grouping. Inversion in pitch is not a function of age.

TABLE VIII (a).
Intensity Variations. (Present.)

I.	IV.	VII.	
7 p. 4 m. o. i. o. ir.	11 p. 4 m. o. i. o. ir.	18 p. 2 m. o. i. o. ir.	G. B.
6 p. 2 m. i. i. o. ir.	8 p. 7 m. o. i. o. ir.	14 p. 3 m. o. i. o. ir.	G. G.
3 p. 0 m. o. i. o. ir.	18 p. 0 m. o. i. o. ir.	9 p. 4 m. o. i. o. ir.	A. B.
10 p. 2 m. o. i. o. ir.	16 p. 2 m. o. i. o. ir.	15 p. 2 m. i. i. o. ir.	A. G.
26 p. 8 m. i. i. o. ir.	53 p. 13 m. o. i. o. ir.	56 p. 11 m. i. i. o. ir.	Total.

TABLE VIII (b).
Intensity Variations. (Absent.)

I.	IV.	VII.	
8	4	3	G. B.
6	8	7	G. G.
18	4	5	A. B.
10	3	0	A. G.
42	19	15	Total.

It was often difficult to distinguish between a slight rise in pitch and a slight increase in intensity. Repetition was then required.

The dissimilarity between Germans and Americans is not so marked as in Table VII. The first grade Americans are distinctly less rhythmical than the German children of the same age. The correlation between increased intensive variations and increased age is even more marked than the same correlation in the case of pitch. Inversion is far less frequent in intensity than in pitch.

TABLE IX (a).
Temporal Variations. (Present.)

I.	IV.	VII.	
4 p. o m. o i. o ir.	9 p. 1 m. o i. o ir.	14 p. o m. o i. o ir.	G. B.
3 p. 1 m. o i. o ir.	7 p. 4 m. 1 i. o ir.	14 p. 3 m. 1 i. o ir.	G. G.
4 p. o m. o i. o ir.	20 p. o m. o i. o ir.	10 p. 4 m. 1 i. o ir.	A. B.
13 p. o m. 1 i. 1 ir.	13 p. 2 m. o i. o ir.	9 p. 7 m. 2 i. o ir.	A. G.
24 p. 1 m. 1 i. 1 ir.	49 p. 7 m. 1 i. o ir.	47 p. 14 m. 4 i. o ir.	Total.

TABLE IX (b).
Temporal Variations. (Absent.)

I.	IV.	VII.	
15	9	9	G. B.
12	11	7	G. G.
17	2	3	A. B.
8	6	1	A. G.
52	28	20	Total.

(1) Increased tendency toward temporal subordination in grouping runs parallel with increase in mental development; the difference between the first and fourth grades, in this respect, is greater than that between the fourth and seventh. (2) There are numerous cases of inversion. These arose through prolongation of the last syllable into the time of the pause. Inversion here, as elsewhere, does not seem to be a function of age; it is even more frequent with the older children. (3) The effect of practice is greater upon the German children; with them there was a marked increase of temporal and intensive differentiation in the fourth and fifth series, and a corresponding increase in the unity of the grouping. In the case of the American children, the rhythm of the third, fourth and fifth series showed scarcely any deviations from that of the first.

Are there closer relationships existing between any two of these objective factors than between the others? When the rhythms are not determined by all three, temporal, intensive

and qualitative, which two appear most frequently together? An answer to this question would throw light upon the subjective nature of these objective factors. The results have been tabulated to show these relations.

TABLE X.

P. and I. present together.			T. and I. present together.			P. and T. present together.			Total.
I.	IV.	VII.	I.	IV.	VII.	I.	IV.	VII.	
9	5	6	0	0	0	2	1	0	G. B.
7	8	2	0	0	2	1	2	2	G. G.
1	0	1	1	5	3	1	2	1	A. B.
1	5	0	2	3	3	0	2	0	A. G.
18	18	9	3	8	8	4	7	3	

P. T. and I. present together.			P. T. and I. absent.			Total.
I.	IV.	VII.	I.	IV.	VII.	
2	9	14	17	9	9	G. B.
3	8	14	12	12	9	G. G.
0	11	9	22	11	9	A. B.
8	13	14	14	9	8	A. G.
13	41	51	65	41	35	

The mediation of the grouping through variation in pitch and intensity alone appears frequently among the Germans; it is less noticeable in the upper grades, as all three factors are there more often present. A *T-I* grouping is more characteristic of the Americans; while a grouping mediated by *P* and *I* seldom characterizes the German or American reading. This would seem to indicate that pitch cannot be a complete substitute for intensity, but rather serves to heighten the effect of an intensity variation. Cf. the discussion of pitch, for the relations between pitch and intensity.

The rhythm certainly gained in richness of content and unity of impression with increase in years.

Pause.—Unfortunately for the results, as to the relation of the pause in the group, the observations on German children are incomplete. The position of the pause was noted only in very striking cases; consequently, a satisfactory basis for comparison with the results obtained from American children is wanting, as absence or presence, regularity or irregularity, was noted here in every reading.

TABLE XI (a).
Position of Pause. Americans.

(Results for boys and girls given together.)

I.	IV.	VII.	
44	44	37	
TOTAL NUMBER OF READINGS.			
8	4	4	Pause after each syllable.
29	40	33	Pause after every second syllable only.
—	—	1	Pause after third syllable only.
12	1	1	Absent or irregular.

TABLE XI (b).
Position of Pause. Germans.

(Results for boys and girls given together.)

I.	IV.	VII.	
34	38	48	
TOTAL NUMBER OF READINGS.			
5	1	2	Pause after each syllable.
12	20	15	Pause after every second syllable.
0	1	0	Pause after every third syllable.
?	?	?	Absent or irregular.

There are frequent lapses into a primary rhythm in the trochaic reading of the first grade. With one exception, this primary grouping retained the temporal, intensive or qualitative subordination characteristic of a trochaic grouping.

There are a large number of irregular readings among the American children of the first grade; the boys, particularly, were very unrhythymical.

Results from the Trochaic Readings by Method II. Figures for time and pitch represent the mean values for each series.

TABLE XII.—C. D.

TIME.		Intensity.	Pitch.		
Syllable. (a)	(b)	Pause. (a)	(b)		
(1) .789 sec.	.361 sec.	.093 sec.	.435 sec.	a > b (3); a=b (8)	a=b
(2) .743 "	.313 "	.102 "	.597 "	a=b (12)	a=b
(3) .985 "	.312 "	.12 "	.402 "	a > b (4); a=b (6)*	a higher than b.
(4) .87 "	.311 "	.102 "	.545 "	a=b (11)*	a higher than b.
(5) .767 "	.398 "	.062 "	.358 "	a=b (14)	a 318.75 vib. b 318.75 vib.
(6) .802 "	.504 "	.065 "	.311 "	a > b (6); a=b (1)	a 300.93 " b 288.43 "

*The microphone responded poorly.

TABLE XIII.—*H.*

TIME.				Intensity.	Pitch.		
Syllable.		Pause.					
(a)	(b)	(a)	(b)				
(1) .419 sec.	.25 sec.	.183 sec.	.416 sec.	a> b (7); a=b (2)	a higher than b		
(2) .46 "	.365 "	.142 "	.23 "	a> b (15); a=b (1)	a " " b		
(3) .444 "	.448 "	.14 "	.206 "	a> b (13)*	a " " b		
(4) .52 "	.438 "	.131 "	.24 "	a> b (15)*	a " " b		
(5) .409 "	.414 "	.115 "	.131 "	a> b (14)	a 306.25 vib. b 257.69 vib.		

**a* twice as intensive as *b*.

Pitch intervals vary between a second and a fourth.

TABLE XIV.—*R. A.*

TIME.				Intensity.	Pitch.		
Syllable.		Pause.					
(a)	(b)	(a)	(b)				
(1) .58 sec.	.445 sec.	.43 sec.	.595 sec.	a=b (10)	a=b		
(2) .57 "	.457 "	.42 "	.513 "	a> b (7); a=b (3)	a=b		
(3) .504 "	.195 "	.19 "	.984 "	a=b (12)*	a=b		
(4) .488 "	.397 "	.193 "	.638 "	a=b (10)*	a=b		
(5) .628 "	.575 "	.413 "	.44 "	a> b (3); a=b (7)	a higher than b		
(6) .637 "	.56 "	.362 "	.437 "	a> b (3); a=b (5)	a higher than b		
(7) .647 "	.347 "	.387 "	.493 "	a=b (10)	a higher than b		

*The microphone responded poorly.

Difference in pitch, when present, never exceeded the major second.

Some of the series were taken under favorable conditions, the microphone responding as readily as could be desired; where particular difficulties were experienced, they have been noted.

There was a secondary grouping in the reading of *H.* and *C. D.*, corresponding to the breathing rhythm, which could not be shown in the tabulated results; each of the larger groups contained six to ten smaller groups (or in metrical language 6 to 10 feet). The larger groups were separated by longer pauses of .3 to .7 sec. in duration.

The difference between the lengths of the intervening and the succeeding pause increased from the first grade up; *R. A.* (first grade) gave, with the exception of two series, very slight time-differences in her readings; with *H.*, the differences in duration of the pauses, although greater than with *R. A.*, were not marked; while with *C. D.* they were very marked. The same thing is true of the duration of the syllables, but in a less noticeable degree.

The results for intensity are not entirely satisfactory, for, as

C. D. complained at the time of the third series, in order to give the weak syllable intensity enough to insure a response from the microphone, it was necessary to speak so loudly that the loudest syllable could hardly be made more intense. The correlation between greater frequency and completeness of intensive subordination and increase in age is not borne out in this experiment. The lack of delicacy in the responses of the microphone was, no doubt, a partial cause, although not a sufficient one. The natural reading of *C. D.* never showed great intensive variations.

In the two cases where *R. A.*'s reading showed a noticeable temporal subordination, there was neither an intensive nor a qualitative differentiation present: this was a case of supplementing similar to Meumann's *Stellvertretung*. *R. A.*'s grouping is not of any particular type; it is partly temporal, partly intensive, and for the last series slightly qualitative.

H. tends to a markedly intensive-qualitative rhythm; temporal differences are very slight. In series (3) he approached a spondaic time order. Pitch differences are always present, and greater than for *C. D.* or *R. A.* *C. D.*'s reading is of a temporal type, with few or slight differences in intensity or pitch, but with striking differences in temporal arrangement.

H.'s reading was always more natural, less strained, than that of *C. D.* *C. D.* was, as has been stated, a very painstaking, conscientious child, and labored to give what he thought was desired; while *H.* read as he pleased. It is therefore probable that in the grouping given by *H.* we have a nearer approach to the natural spontaneous rhythm of speech.

The figures for pitch are, like those for time, averages of long series; they do not therefore represent the number of vibrations which were actually given, but show all that they were expected to represent,—the relative intervals between the two syllables. In the readings given by *R. A.*, and in the greater number of those given by *H.* and *C. D.*, it was impossible to read the number of vibrations as shown on the record. By a change in the recording apparatus and an increase of the rate of revolution of the drum, we were enabled, however, to obtain a few records which showed approximately the number of vibrations; it was necessary, even in this case, to use a magnifying glass for reading the records.

It is to be noted that the time-relations could not be expressed by simple numbers.

Total for Five Series of Iambic Readings.

In this case the children were requested to emphasize the second and every alternate syllable.

TABLE XV (a).
Pitch Variations. (Present.)

I.	IV.	VII.	
6 p. 2 m. 10 i. 2 ir.	14 p. 0 m. 1 i. 1 ir.	10 p. 9 m. 3 i. 1 ir.	G. B.
9 p. 1 m. 4 i. 0 ir.	13 p. 4 m. 1 i. 0 ir.	20 p. 1 m. 3 i. 1 ir.	G. G.
7 p. 2 m. 0 i. 2 ir.	13 p. 0 m. 6 i. 0 ir.	17 p. 0 m. 0 i. 0 ir.	A. B.
4 p. 0 m. 0 i. 1 ir.	9 p. 3 m. 2 i. 0 ir.	14 p. 0 m. 0 i. 2 ir.	A. G.
26 p. 5 m. 14 i. 5 ir.	49 p. 7 m. 10 i. 1 ir.	47 p. 10 m. 6 i. 4 ir.	Total.

TABLE XV (b).
Pitch Variations. Absent.

I.	IV.	VII.	
0	3	0	G. B.
2	0	0	G. G.
13	3	2	A. B.
16	7	5	A. G.
31	13	7	Total.

(1) The parallelism between increasing differentiation of the rhythm and increasing age is still noticeable, although there is scarcely any difference between the fourth and the seventh grades in this respect. (2) A qualitatively determined rhythm still appears to be characteristic of the German rather than of the American reading. (3) The cases of inversion are much more frequent than with the trochee; this is particularly true of the Germans, who in such cases reverted to a pure trochaic form. (4) Comparing the trochaic and iambic groupings as to pitch relations, we note that there is exactly the same number of absences in the iambic as in the trochaic readings of both the first and fourth grades; but with the seventh grade, pitch variations are absent but seven times, while with the trochee they are wanting in eleven readings. (5) There are fewer instances of intervals of a fourth in the iambus than in the trochee; the intervals often gradually diminished as the reading proceeded. This fluctuation in pitch was a characteristic feature of the iambic grouping.

(1) Regular intensive variations are less frequent than are qualitative. (2) They occur more rarely than in the trochaic grouping. The greater variety of intensive variations in the iambus is doubtless due to the same cause as the smaller pitch intervals. The result is a weakening and fading-out of the

TABLE XVI (a).
Intensity Variations. (Present.)

I.	IV.	VII.	
6 p. 4 m. 1 i. o ir.	7 p. 5 m. o i. o ir.	16 p. 2 m. o i. o ir.	G. B.
6 p. 5 m. o i. 1 ir.	16 p. 4 m. o i. o ir.	13 p. 2 m. o i. o ir.	G. G.
2 p. 0 m. o i. o ir.	9 p. 2 m. 1 i. 1 ir.	9 p. 2 m. 2 i. o ir.	A. B.
7 p. 2 m. o i. 4 ir.	7 p. 2 m. 1 i. 2 ir.	12 p. 3 m. o i. o ir.	A. G.
21 p. 11 m. 1 i. 5 ir.	39 p. 13 m. 2 i. 3 ir.	40 p. 9 m. 2 i. o ir.	Total.

TABLE XVI (b).
Intensity Variations. (Absent.)

I.	IV.	VII.	
3	7	5	G. B.
3	3	8	G. G.
20	7	6	A. B.
11	7	5	A. G.
37	24	24	Total.

distinctive marks. Cf. later discussion. (3) Correlation of increasing intensive differentiation with increasing age is still to be noted, although not marked.

TABLE XVII (a).
Time Variations. (Present.)

I.	IV.	VII.	
2 p. 0 m. 1 i. o ir.	9 p. 3 m. o i. o ir.	13 p. 1 m. o i. o ir.	G. B.
2 p. 1 m. 2 i. o ir.	11 p. 4 m. 1 i. o ir.	11 p. 4 m. 4 i. o ir.	G. G.
3 p. 0 m. 2 i. o ir.	10 p. 1 m. 2 i. o ir.	10 p. 2 m. 1 i. o ir.	A. B.
9 p. 0 m. 2 i. o ir.	10 p. 1 m. 2 i. o ir.	10 p. 2 m. 1 i. o ir.	A. G.
16 p. 1 m. 7 i. o ir.	40 p. 9 m. 5 i. o ir.	44 p. 9 m. 7 i. o ir.	Total.

TABLE XVII (b).
Time Variations. (Absent.)

I.	IV.	VII.	
15	7	9	G. B.
11	7	6	G. G.
17	8	5	A. B.
9	4	4	A. G.
52	26	24	Total.

(1) Cases of inversion in the temporal relations are far more numerous in the iambus than in the trochee; although subordinations in temporal arrangement are about as frequent. (2) The irregularities found in the intensive, and still more often in the qualitative arrangement disappear here entirely. (3) The parallelism found in all the other instances is still to be noted.

TABLE XVIII.

P. and I. present together.			T. and I. present together.			P. and T. present together.			
I.	IV.	VII.	I.	IV.	VII.	I.	IV.	VII.	
13	5	5	1	3	1	0	2	0	G. B.
7	5	3	1	1	3	0	0	0	G. G.
0	2	3	2	2	3	1	2	3	A. B.
2	3	2	2	4	3	4	1	0	A. G.
22	15	13	6	9	10	5	5	3	Total.

P., T. and I. present.			P., T. and I. absent.		
I.	IV.	VII.	I.	IV.	VII.
1	5	12	18	13	11
4	15	13	11	5	12
0	9	7	22	13	11
3	11	11	19	11	8
8	40	43	70	42	42

A grouping marked only by variations in *P.* and *I.* is still favored by the German children, especially by the first grade boys. *P.* and *T.* variations seldom occur alone; this was noted in the trochaic grouping. *T.* and *I.* are still favored by the Americans rather than by the Germans. *P.*, *T.* and *I.* subordinations within the same group are less frequent than in the trochee; this is especially true of the first grade. An exception to this rule is furnished by the reading of the German girls in the fourth grade; it can be partly accounted for by the fact that the full number of readings was given by a girl of a distinctly iambic-anapaestic type. In general we note here the same tendency to a looser grouping, *i. e.*, one possessing fewer distinctive marks, that was before noted.

Pause.—For the reason before mentioned, the results from the German children are not complete.

A pause often occurs after the first syllable, together with differences in pitch and in intensity. In the primary grouping, each syllable was frequently pronounced with a strong expira-

TABLE XIX (a).
Position of Pause. Americans.
 (Results for boys and girls given together.)

I.	IV.	VII.	
44	44	37	
TOTAL NUMBER OF READINGS.			
8	4	1	Pause after each syllable.
25	33*	37	Pause after every second syllable.
11	4	0	Pause absent or irregular.

TABLE XIX (b).
Position of Pause. Germans.
 (Results of boys and girls given together.)

I.	IV.	VII.	
34	38	48	
TOTAL NUMBER OF READINGS.			
5	1	0	After every syllable.
6	9	23	After every second syllable.
?	?	?	Absent or irregular.

* One child gave a double two-grouping by lengthening the pause after the fourth in relation to that after the second syllable.

tory movement. There are more instances of irregularities than in the trochaic rhythm. A reversion to forms 2 and 3 of the involuntary series, *i. e.*, a grouping effectuated by pause alone, occurred eleven times among the American boys of the first grade and six times among the girls of the same grade.

With the first grade, the iambic grouping is loose, *i. e.*, it lacks the unitary character of the trochaic; it is frequently turned into the trochaic form through inversion in time, pitch or intensity, or in all three.

Results from the Iambic Readings by Method II. Figures for time and pitch represent the mean values of each series.

TABLE XX.—C. D.

TIME.		Intensity.		Pitch.
Syllable.	Pause.	(a)	(b)	
(1) .613 sec.	.685 sec.	.13 sec.	.3 sec.	b> a (14); b=a (1)
(2) .607 "	.625 "	.121 "	.344 "	b> a (9); b=a (4)
(3) .733 "	.766 "	.123 "	.251 "	b> a (10); b=a (2)
(4) .716 "	.688 "	.123 "	.345 "	b> a (11); b=a (1)
(5) .803 "	.792* "	.086 "	.166 "	b> a (1); b <a (14)* a 313.33 vib.
(6) .71 "	.767 "	.076 "	.196 "	b> a (1); b=a (4); b <a (6) b 362.22 " a 282.35 " b 297.97 "

*Time and intensity trochaic, voice-fall iambic.

TABLE XXI.—*H.*

TIME.				Intensity.	Pitch.		
Syllable.		Pause.					
(a)	(b)	(a)	(b)				
(1) .495 sec.	.439 sec.	.112 sec.	.225 sec.	Record not clear.	b higher than a		
(2) .389 "	.385 "	.116 "	.298 "	b> a (8); b=a (3)	b " " a		
(3) .415 "	.451 "	.147 "	.195 "	b> a (12); b=a (1); b <a (3)	b " " a		
(4) .379 "	.27*	.223 "	.496 "	b> a (2); b=a (2); b <a (10)	b " " a		
(5) .398 "	.34 "	.148 "	.203 "	b> a (14); b=a (4); b <a (1)	b " " a		
(6) .483 "	.374 "	.151 "	.293 "	b> a (12); b=a (3); b <a (1)	b " " a		
(7) .364 "	.411 "	.116 "	.146 "	b> a (15); b=a (1)	a 298.9 vib. b 371.25 vib.		

*He begins after each inspiration with a trochaic grouping, which gradually becomes iambic; fluctuation between trochaic and iambic grouping is characteristic of the whole series.

TABLE XXII.—*R. A.*

TIME.				Intensity.	Pitch.		
Syllable.		Pause.					
(a)	(b)	(a)	(b)				
(1) .555 sec.	.362 sec.	.437 sec.	.59 sec.	b=a (12)	No variations		
(2) .486 "	.486 "	.4 "	.432 "	b> a (6); b=a (4); b <a (1)	" "		
(3) .417 "	.293 "	.323 "	.866 "	b=a (10)	" "		
(4) .398 "	.38 "	.267 "	.745 "	b=a (7); b <a (3)	" "		
(5) .414 "	.442 "	.36 "	.431 "	b=a (12)	" "		
(6) .473 "	.437 "	.437 "	.466 "	b=a (12)	" "		
(7) .582 "	.537 "	.411 "	.35 "	b=a (8); b <a (3)	a higher than b		
(8) .51 "	.568 "	.446 "	.473 "	b> a (2); b=a (9); b <a (1)	a higher than b		

R. A., as a rule, gave the iambus the temporal arrangement of the trochee; exceptions to this rule were: in series 2, (a) and (b) were of exactly the same duration; and series (5) and (8) showed a slight lengthening of the second syllable in comparison with the first. When intensive subordinations occurred, though these were less frequent than temporal, (a) was more intense than (b), except during part of series (2) and (8), where (b) was slightly more intense than (a). Voice-fall, if noticeable at all, was always trochaic. A tendency to primary grouping, through making the pause following (a) nearly as long as that following (b), was characteristic of *R. A.*'s reading as a whole; this is especially true of series (5), (6), (7) and (8). A peculiarity of series (7) is the presence of a longer pause after (a) than after (b).

With *H.* there is evidence of a conflict between the tendency to give the more natural trochaic grouping and his desire to read as asked. The temporal arrangement is trochaic in series (1), (2), (4), (5) and (6). Intensive subordinations are far more frequent than with *R. A.*; part of every series has an

iambic arrangement of intensity, although no one series has this arrangement only. The voice-fall throughout is that found to be typical of the iambic grouping; the interval is slightly greater than in the trochee. Here, as in the results obtained from the trochaic reading, *H.*'s reading was determined by intensive and qualitative rather than by temporal subordination. His arrangement of pauses [(b) having a greater duration than (a)] results in a more unitary grouping than the arrangement given by *R. A.*

With the exception of series (4) and (5), *C. D.* preserved the characteristic temporal arrangement of the iambus, although the difference between the duration of (a) and (b) was not so great as in the trochaic reading; there, (b) had a duration varying from one-half to one-third that of (a), while here the difference never exceeded a few hundredths of a second. Neither is the relative difference in the duration of the pauses so great as with the trochee; however, the subordination of the intervening pause to the succeeding is greater than in *H.*'s reading, and markedly greater than in *R. A.*'s. While the syllables (a) and (b) are often given the same intensity, the only cases of inversion in intensive arrangement are found in series (5) and (6). The voice-fall throughout was the characteristic iambic. *C. D.*'s reading as a whole was characterized by fewer inversions than *H.*'s and greater unity in the grouping than *R. A.*'s. All three experienced greater difficulty in rendering the iambic; this is in harmony with the result obtained by Method I.

Total for Five Series of Dactylic Readings.

The problem was modified by requiring the emphasis on the first syllable and every third following. Four arrangements of the syllables, as to pitch, (a) (b) (c) (d) were noted. The arrangement is not intended to denote absolute relations, but merely to show the direction of variation.

TABLE XXIII.

German.			American.				
I.	IV.	VII.	I.	IV.	VII.		
4	0	0	Order (a)	20	5	4	Order (a)
13	18	25	" (b)	7	30	26	" (b)
9	2	2	" (c)	0	3	4	" (c)
3	10	4	" (d)	0	0	2	" (d)

This tabulation does not account either for the irregular readings or for the cases of inversion, which would have nearly an obverse arrangement. In the reading given by the German

children, it is to be observed that arrangement (a) occurs only in the first grade; (c) occurs more frequently in the first grade; (b), the commonest form, is found in all the grades; (d) occurs more frequently in the higher grades. If we compare the readings of the American with those of the German children, the greater frequency of arrangement (a) in the reading of the former is noticeable; (c) occurs more frequently in the readings of the fourth and seventh American grades than with the Germans; while (b) seems in the great majority of cases to be the closest grouping obtained by the Americans, (d) occurring only twice, and then in the seventh grade. This shows, even more strikingly than the results obtained in the trochaic and iambic readings, the greater tendency of the German children toward the introduction of a qualitative determinant into the simplest grouping.

It might be asked whether the ascending order of rhythmical grouping, as to unity and complexity of the rhythm, is in the order (a), (b), (c) and (d). Does (d) give a more unitary impression than (b)? For us, (d) is a much more satisfactory arrangement. Cf. the discussion of pitch below.

TABLE XXIV (a).
Pitch Variations. (Present.)

I.	IV.	VII.	
13 p. 1 m. 4 i. o ir.	14 p. 3 m. o i. 1 ir.	14 p. 7 m. o i. 1 ir.	G. B.
9 p. 1 m. o i. 3 ir.	15 p. 7 m. o i. o ir.	21 p. 2 m. o i. 1 ir.	G. G.
o p. 1 m. o i. 1 ir.	13 p. 2 m. 2 i. o ir.	12 p. 2 m. 1 i. o ir.	A. B.
6 p. 1 m. 1 i. o ir.	18 p. 1 m. o i. o ir.	12 p. 3 m. 2 i. o ir.	A. G.
28 p. 4 m. 5 i. 4 ir.	60 p. 13 m. 2 i. 1 ir.	59 p. 14 m. 3 i. 2 ir.	Total.

TABLE XXIV (b).
Pitch Variations. (Absent.)

I.	IV.	VII.	
1	1	0	G. B.
3	0	1	G. G.
18	5	3	A. B.
16	3	2	A. G.
38	9	6	Total.

The American boys of the first grade, and three of the girls, failed in every attempt to produce the dactyl and the anapæst, falling into an unaccented two-grouping, a weakly accented

trochaic or an irregular primary rhythm. The same facts come out in this Table as were observed in Tables VII and XV.

TABLE XXV (a).
Intensity Variations. (Present.)

I.	IV.	VII.	
9 p. 3 m. o i. o ir.	13 p. 2 m. o i. 1 ir.	12 p. 5 m. o i. o ir.	G. B.
5 p. 2 m. o i. 1 ir.	14 p. 4 m. o i. o ir.	14 p. 5 m. o i. o ir.	G. G.
2 p. o m. o i. 4 ir.	11 p. 1 m. 3 i. o ir.	10 p. 4 m. o i. o ir.	A. B.
10 p. 5 m. o i. o ir.	14 p. 4 m. o i. o ir.	13 p. 1 m. 3 i. o ir.	A. G.
26 p. 10 m. o i. 5 ir.	52 p. 11 m. 3 i. 1 ir.	49 p. 15 m. 3 i. o ir.	Total.

TABLE XXV (b).
Intensity Variations. (Absent.)

I.	IV.	VII.	
7	3	5	G. B.
8	4	6	G. G.
15	7	4	A. B.
9	4	2	A. G.
39	18	17	Total.

(1) This Table shows the same relations between age of individual and completeness of grouping that we have found in the others. (2) Inversions are less frequent than in the case of the iambus. (3) The intensity relations are more varied than in the two-groupings. As a rule, the second was less intense than the third, which was in turn less intense than the first (—' — —'); having, however, no accurate means of recording these differences, we cannot give the different arrangements as accurately as in the case of pitch. Cf. results from Method II; also discussion of the arrangement found by Bolton.

TABLE XXVI (a).
Time Variations. (Present.)

I.	IV.	VII.	
10 p. o m. o i. o ir.	11 p. 5 m. o i. o ir.	12 p. 6 m. o i. o ir.	G. B.
3 p. o m. o i. o ir.	7 p. 1 m. o i. o ir.	15 p. 8 m. o i. o ir.	G. G.
2 p. o m. 1 i. 2 ir.	12 p. 4 m. 3 i. o ir.	11 p. 6 m. o i. o ir.	A. B.
10 p. 1 m. o i. o ir.	12 p. 7 m. 1 i. o ir.	14 p. 1 m. 3 i. o ir.	A. G.
25 p. 1 m. 1 i. 2 ir.	42 p. 17 m. 4 i. o ir.	52 p. 21 m. 3 i. o ir.	Total.

TABLE XXVI (b).
Time Variations. (Absent.)

I.	IV.	VII.	
9	3	4	G. B.
13	4	2	G. G.
16	3	3	A. B.
13	2	1	A. G.
51	12	10	Total.

(1) There are fewer irregularities in the temporal than in the intensive and qualitative arrangement. (2) The parallelism between increased age and increased frequency of differentiating marks, found in all the other Tables, does not fail here.

There were a number of temporal arrangements observed; at times the first seemed as long as the second and third together; then the first appeared only a trifle longer than the second, and the second longer than the third; and then again the first had the greatest duration, the third came next in order of duration, while the second had the least. These results were objectively substantiated by the results of Method II. Cf., for further discussion, temporal factor in rhythm.

TABLE XXVII.

P. and I. present together.			T. and I. present together.			P. and T. present together.			
I.	IV.	VII.	I.	IV.	VII.	I.	IV.	VII.	
4	1	3	0	1	0	1	0	3	G. B.
6	2	1	0	3	1	2	2	0	G. G.
0	1	1	1	2	1	0	0	0	A. B.
2	0	0	3	1	1	0	0	1	A. G.
12	4	5	4	7	3	3	2	4	Total.

P. T. and I. present.			P. T. and I. absent.		
I.	IV.	VII.	I.	IV.	VII.
8	14	14	11	4	9
0	16	16	15	4	9
1	11	10	21	11	8
5	16	15	17	6	4
14	57	55	64	25	30

It is interesting to note how much more complete the dactylic

grouping is than the trochaic or the iambic. P., T. and I variations occur together:

	I.	IV.	VII. GRADES.
In the trochaic readings,	13	41	51 times.
In the iambic readings,	8	40	43 times.
But in the dactylic readings,	14	57	55 times.

The greater number of possible arrangements of these three factors gives a variety and richness of content impossible in the two-groupings.

TABLE XXVIII (a).
Position of Pause. Americans.

(Results for boys and girls given together.)

I.	IV.	VII.	TOTAL NUMBER OF READINGS.
44	44	37	
8	I	0	After every syllable.
6	2	0	After every second syllable.
12	20	20	After every third.
6	18	16	After first and third.
12	3	I	Absent or irregular.

TABLE XXVIII (b).
Position of Pause. Germans.

(Results for boys and girls given together.)

I.	IV.	VII.	TOTAL NUMBER OF READINGS.
44	44	37	
8	I	I	After every syllable.
1	I	0	After every second syllable.
5	II	II	After every third.
8	15	24	After every first and third.
?	?	?	Absent or irregular.

(1) There was frequently a minor pause after the first with a longer pause after the third; this was especially true of the readings of the children of the upper grades. (2) We still find instances, notably in the first grade, in which a pause occurred after each syllable; generally then the primary rhythm was produced, though there were instances in which accented syllables were so separated. The appearance of the two-grouping also marked the failure of the younger children to bring the three syllables into an unity.

	TIME.						
	Syllable.			Pause			
	(a)	(b)	(c)	(a)			
(1)	.665	sec.	.607 sec.	.437 sec.	.171 sec.	.161 sec.	a>
(2)	.686	"	.601 "	.425 "	.145 "	.175 "	a>
(3)	1.016	"	.511 "	.363 "	.163 "	.216 "	a>
(4)	.894	"	.525 "	.394 "	.247 "	.161 "	a>
(5)	.677	"	.632 "	.452 "	.311 "	.267 "	
(6)	.679	"	.636 "	.528 "	.069 "	.082 "	

	TIME.						
	Syllable.			Pause			
	(a)	(b)	(c)	(a)			
(1)	.365	sec.	.391 sec.	.309 sec.	.174 sec.	.176 sec.	
(2)	.381	"	.429 "	.256 "	.152 "	.181 "	a>
(3)	.348	"	.338 "	.293 "	.103 "	.113 "	

	TIME.						
	Syllable.			Pause			
	(a)	(b)	(c)	(a)			
(1)	.409	sec.	.3 sec.	.328 sec.	.435 sec.	.495 sec.	
(2)	.473	"	.321 "	.358 "	.43 "	.506 "	a>
(3)	.434	"	.305 "	.198 "	.406 "	.516 "	a>
(4)	.51	"	.428 "	.403 "	.45 "	.404 "	
(5)	.646	"	.577 "	.555 "	.46 "	.477 "	a>
(6)	.413	"	.4 "	.354 "	.381 "	.412 "	
(7)	.439	"	.367 "	.315 "	.333 "	.406 "	

Results from the dactylic readings by Method II.

TABLE XXIX.—C. D.

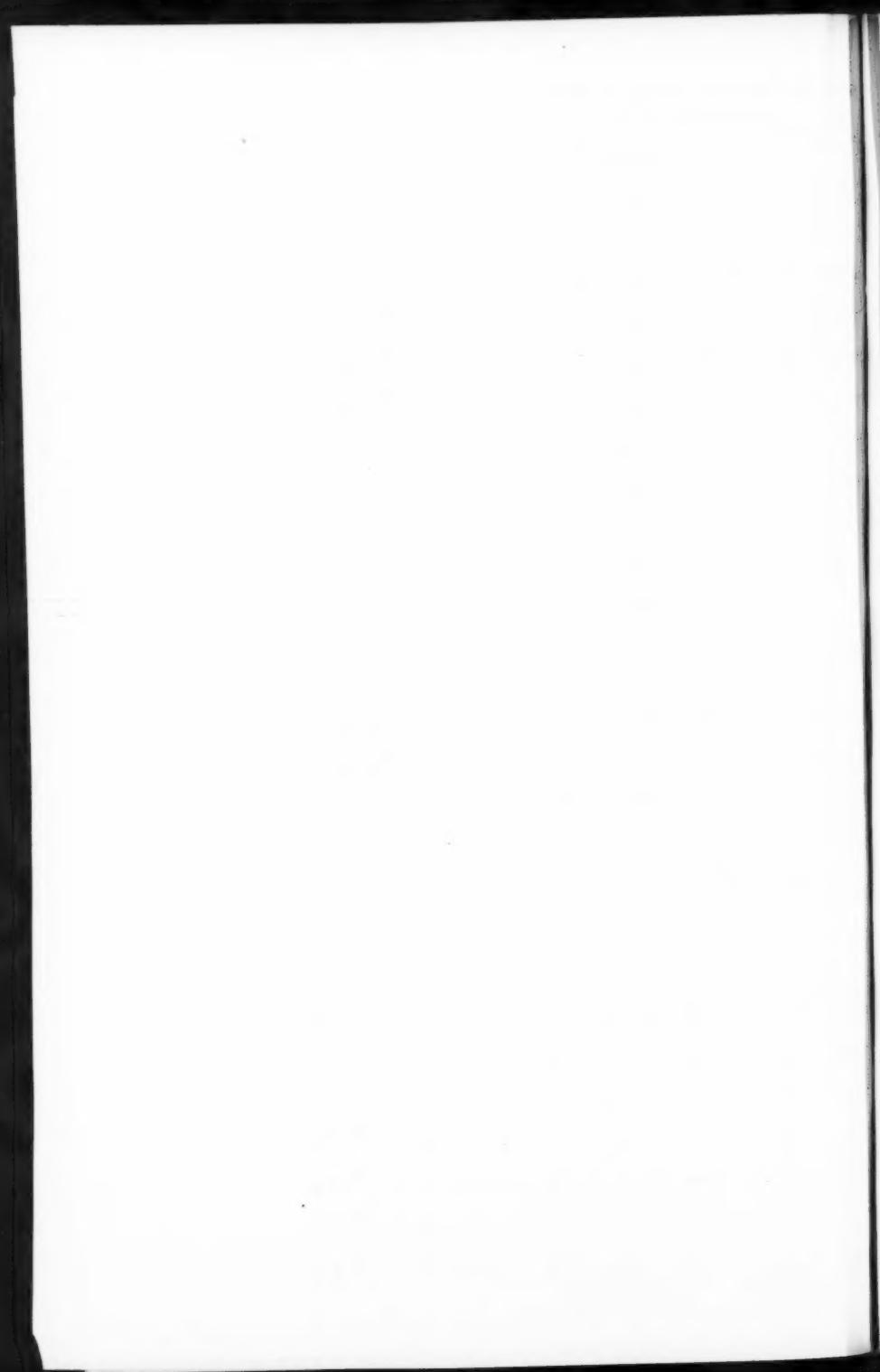
	INTENSITY.	PITCH.
Pause		
c. .161 " a> b> c (3); a> b and c (5); a> c> b (1)		?
.175 " a> b> c (1); a> b and c (5); a> c> b (2)		
.216 " a> b> c (2); a> b and c (5); a> c> b (2)		
.161 " a> b> c (2); a> b and c (5); a> c> b (2)		
.267 " a> b and c (15)		(a) 311 vib. (b) 267.5 vib. (c) 276.8 vib.
.082 " a> b and c (4)	a=b=c (4)	(a) 336 vib. (b) 266 vib. (c) 325 vib.

TABLE XXX.—H.

	INTENSITY.	PITCH.
Pause		
c. .176 sec. a> b and c (8);	a=b=c (3); [c> a> b (1)]	
.181 " a> b> c (3); a> b and c (1);	a=b=c (7)	
.113 " a> b and c (8); a> c> b (5)		(a) 392.2 vib. (b) 294.6 vib. (c) 295.7 vib.

TABLE XXXI.—R. A.

	INTENSITY.	PITCH.
Pause (b)		
.495 sec. a> b and c (5); a> c> b (1); a=b=c (1)		No pitch difference.
.506 " a> b> c (2); a> b and c (2); a> c> b (1); a=b=c (2)		" " "
.516 " a> b> c (6);	a> c> b (1); a=b=c (1)	" " "
.404 " a=b=c (6)		
.47 " a> b> c (1); a> b and c (2); a=c=b (1); a and b> c (2)		
.412 " a=b=c (8)		
.406 " a=b=c (8)		



R. A. In general the time order was _____, _____, _____; but in series (1) and (2) the order is _____, _____, _____; this order was often present in the breathing rhythm, when it was not apparent in the spoken rhythm synchronously given. It was also frequently found in the freer readings of Method I. The difference in duration of the pauses was very slight; again, as in the iambic readings as well as in her breathing rhythm, we see evidence of a very loose grouping, at times only very slightly differentiated from the primary. As a rule the shortest pause occurred after the long syllable, and the longest after the last. This arrangement of pauses was not found in the readings without the microphone.

In three series there was no regular intensity variation. The arrangement _____' _____ occurred seven times; _____" _____' _____ four times. This arrangement was scattered through the different series. Order _____" _____ was found nine times. Where pitch differences were present, only the arrangements noted as (b) and (c) were found.

H. The fewer series shown for *H.* are due to difficulties arising from the adjustment of the microphone; several series were illegible, and therefore could not be utilized. The experiments were made during the height of the winter season, and sudden changes of temperature in the experimenting room were unfavorable to a perfect adjustment of the microphone. In series (1) and (2) we have an unusual arrangement as to time; _____, _____, *i. e.*, the second syllable longer than the first. The order of series (3) _____, _____ was frequent in *R. A.*'s reading; it is the only order which Bolton and McKay and Hurst regard as characteristic of dactylic grouping. Cf. later discussion. The order given in series (1) and (2) can scarcely be regarded as natural; it can easily be accounted for by the resistance of the microphone. This was greater for the initial syllable, and led to an overestimation of the first syllable and an underestimation of the second; and a temporal inversion was the result. Intensive variations were not as frequent as in the trochaic and iambic readings. The arrangements were _____' _____ noted 17 times, _____" _____ noted 3 times; _____" _____ noted 5 times. There were 10 instances of unaccented readings and one case of inversion. *H.* always had a marked pitch difference, and in the customary direction.

C. D. He never regulated his breathing well; one group followed another with scarcely a pause between, until he was finally forced to stop for breath. The consequence was that the last syllable of the secondary group was cut short; this fact is brought out clearly in the breathing curve. A curious inversion in the duration of the pauses occurred in series (5);

otherwise the duration of the pauses followed the inverse order of the syllables. Variations in intensity were nearly always present. The arrangements were the same as those found in *H.*'s reading; —' —' —' was noted seven times, —' —' —' eight times, and —' —' —' 39 times. There was one case of inversion in pitch (*cf.* last series); otherwise the only two forms noted were those found to be characteristic of the older children in the free readings.

Total for Five Series of Anapestic Readings.

In a general way the anapestic grouping was the obverse of the dactylic, in its temporal, intensive and qualitative arrangements.

TABLE XXXII.

German.			Order (a)	American.		
I.	IV.	VII.		I.	IV.	VII.
0	0	0		0	0	0
12	19	32	(b)	8	27	26
2	2	6	(c)	0	3	1
3	19	9	(d)	0	1	1

Arrangement (d) occurred more frequently in the reading of the German children; this is in harmony with all the results so far obtained. Arrangement (c) appeared very seldom even among the younger children, less frequently even than in the dactylic grouping. Arrangement (b) is most frequent with all the grades.

TABLE XXXIII (a).
Pitch Variations. (Present.)

I.	IV.	VII.	
5 p. 3 m. 7 i. 1 ir.	12 p. 2 m. 1 i. o ir.	11 p. 9 m. o i. 1 ir.	G. B.
7 p. 0 m. 3 i. 2 ir.	15 p. 7 m. 1 i. o ir.	12 p. 8 m. 2 i. o ir.	G. G.
1 p. 0 m. 3 i. o ir.	11 p. 0 m. 4 i. o ir.	12 p. 1 m. 3 i. o ir.	A. B.
3 p. 1 m. 3 i. 1 ir.	14 p. 2 m. 2 i. 1 ir.	13 p. 1 m. 3 i. o ir.	A. G.
16 p. 4 m. 16 i. 4 ir.	52 p. 11 m. 8 i. 1 ir.	48 p. 18 m. 8 i. 1 ir.	Total.

TABLE XXXIII (b).
Pitch Variations. (Absent.)

I.	IV.	VII.	
3	4	1	G. B.
4	0	2	G. G.
17	6	2	A. B.
13	3	3	A. G.
37	13	8	Total.

(1) There were a greater number of large intervals recorded in the German than in the American readings. (2) There were more cases of inversion than in the rendering of dactyls. (3) Pitch entered less frequently as a determinant of grouping than in the dactyl.

TABLE XXXIV (a).
Intensity Variations. (Present.)

I.	IV.	VII.	
6 p. 7 m. o.i. o.ir.	9 p. 4 m. o.i. o.ir.	11 p. 9 m. o.i. 1 ir.	G. B.
5 p. 4 m. 1 i. 1 ir.	13 p. 2 m. o.i. o.ir.	4 p. 6 m. o.i. o.ir.	G. G.
o p. o m. 1 i. 2 ir.	7 p. 2 m. 5 i. o.ir.	14 p. 1 m. o.i. o.ir.	A. B.
9 p. 3 m. o.i. 1 ir.	9 p. 2 m. 2 i. 3 ir.	14 p. o m. 1 i. o.ir.	A. G.
20 p. 14 m. 2 i. 5 ir.	38 p. 10 m. 7 i. 3 ir.	43 p. 16 m. 1 i. 1 ir.	Total.

TABLE XXXIV (b).
Intensity Variations. (Absent.)

I.	IV.	VII.	
5	6	1	G. B.
5	7	15	G. G.
17	5	3	A. B.
13	6	4	A. G.
40	24	23	Total.

The number of inversions in intensity was less than in pitch; but intensive variations were frequently absent.

TABLE XXXV (a).
Time Variations. (Present.)

I.	IV.	VII.	
1 p. 1 m. o.i. o.ir.	8 p. 2 m. o.i. 1 ir.	9 p. 3 m. o.i. o.ir.	G. B.
2 p. o m. 1 i. o.ir.	13 p. 3 m. 1 i. o.ir.	12 p. 8 m. 2 i. 1 ir.	G. G.
1 p. o m. 3 i. o.ir.	9 p. 3 m. 3 i. o.ir.	14 p. 1 m. o.i. o.ir.	A. B.
2 p. 3 m. o.i. 1 ir.	13 p. 3 m. 1 i. 3 ir.	12 p. o m. 2 i. o.ir.	A. G.
6 p. 4 m. 4 i. 1 ir.	43 p. 11 m. 5 i. 4 ir.	47 p. 12 m. 4 i. 1 ir.	Total.

TABLE XXXV (b).
Time Variations. (Absent.)

I.	IV.	VII.	
17	8	10	G. B.
13	6	5	G. G.
17	6	3	A. B.
17	2	5	A. G.
64	22	23	Total.

Time played scarcely any part in the anapæstic grouping of the first grade. There were more inversions in time than in intensity.

TABLE XXXVI.

P. and I. present together.			T. and I. present together.			P. and T. present together.			
I.	IV.	VII.	I.	IV.	VII.	I.	IV.	VII.	
II	5	5	0	2	0	0	2	0	G. B.
7	4	1	2	0	0	0	0	2	G. G.
0	0	3	0	3	2	2	2	0	A. B.
I	0	3	0	2	3	I	0	2	A. G.
19	9	12	2	7	5	3	4	4	Total.

P., T. and I. present.			P., T. and I. absent.			
I.	IV.	VII.	I.	IV.	VII.	
I	5	9	18	13	14	G. B.
I	II	9	14	9	16	G. G.
0	7	8	22	15	10	A. B.
4	14	9	18	8	10	A. G.
6	37	35	72	45	50	Total.

P., T. and I. differences occurred less frequently than in any of the other rhythms. There was the same fading or weakening of the distinctive characteristics, and consequent lack of unity, that were noted in the iambic grouping.

TABLE XXXVII (a).

Position of pause. Americans.

(Results for boys and girls given together.)

I.	IV.	VII.	
44	44	37	TOTAL NUMBER OF READINGS.
11	1	2	At the end of each syllable.
8	1	0	After every second.
9	18	20	After every third.
2	16	12	After second and third.
12	3	2	Absent or irregular.

TABLE XXXVII (b).

Grouping by means of pause alone.

First Grade.		
Germans.	Americans.	
I	7	Pause after every syllable.
I	2	Pause after every second.
I	3	Pause after every third.

TABLE XXXVII. (c).

Position of Pause. Germans.

(Results for boys and girls given together.)

I.	IV.	VII.	
44	44	37	TOTAL NUMBER OF READINGS.
8	2	5	After each syllable.
1	1	0	After every second.
12	13	14	After every third.
5	11	9	After second and third.
?	?	?	Absent or irregular.

This Table emphasizes again the tendency of the younger children to fall into either a primary or two grouping when attempting to give the three grouping. The large number of cases in which the only differentiation among the syllables was that effected by the pause, also the great number of irregular cases, proved the anapæst to be the most difficult arrangement among those attempted.

Results from the Anapæstic Readings by Method II.

While *C. D.* preserved with but few exceptions the customary order, the longest and loudest coming last in the group, the differences (temporal and intensive) are not so marked as

in the reading of the dactyl. Series (4) has a partly inverted time order (the long syllable taking second instead of third place in the group). The first three series have the order _____; only the last series has the order _____, which Bolton regards as typical. There were eight instances of inversion in the arrangements of the intensities; five instances of an entire absence of intensive subordination. The arrangement most frequently given was _____, which occurred thirty times; arrangement _____, _____ was noted eight times; and _____, _____ eight times. There were no inversions in pitch.

There were no inversions in pitch. *H.*'s rhythm was from the first determined by the intensive and qualitative factors. Here we notice that the characteristic intensive arrangement of the anapæst is preserved: the order — — — was most frequent, occurring forty-six times. There are only two cases of partial inversion, in which the first syllable received the same accent as the third. *H.* varied less than *C. D.* from the normal intensive arrangement; but in the temporal arrangements, only the third series can be said to have the characteristic anapæstic order. The order — — — occurred in three series, and order — — — in two series; both of these are dactylic arrangements. The time differences were too slight to affect the general character of the rhythm. These cases of conflict are interesting, as showing how completely a rhythm may be governed by one or two factors. Such a rhythm, however, lacks the unity and completeness that belong to a grouping where all the factors reinforce one another.

In the reading of *R. A.*, the pauses and syllables had nearly the same duration. Series (5) and (6) present almost perfect cases of the rhythm designated in the involuntary grouping as case 4, *i. e.*, a succession of three syllables equal in intensity, in duration and in pitch, separated by equal intervals, but distinguished as a group from the syllables following by the longer interval after the third syllable. This is but one remove from a primary rhythm. The lack of unity in the grouping, the preservation of the primary rhythm within the complex, is clearly shown in *R. A.*'s breathing curve: each syllable corresponded to an expiration, each pause to an inspiration. The inspiration corresponding to the pause after every third syllable was longer than the inspirations corresponding to the first and second. There were very few instances in which one syllable was subordinated to another in intensity; but in those cases the characteristic anapaestic arrangement was inverted, in every instance but one (the arrangements were either —' — —, which occurred seven times, or —' —' —, which occurred four times). The single series in which a variation of pitch was

TABLE XXXVIII.—C. D.

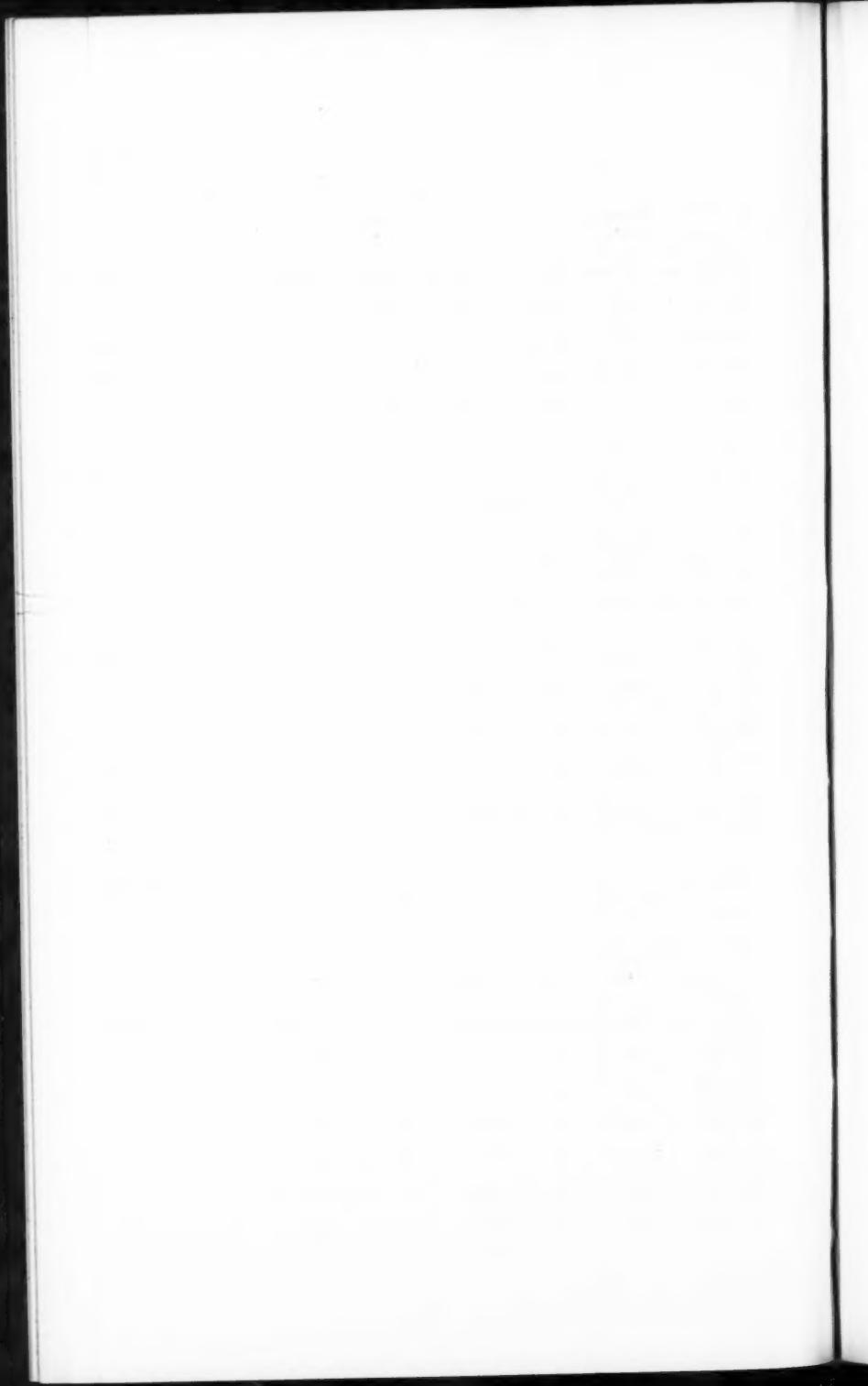
TIME.						INTENSITY.			PITCH.	
Syllable.			Pause.							
(a)	(b)	(c)	(a)	(b)	(c)					
(1) .33 sec.	.283 sec.	.463 sec.	.096 sec.	.107 sec.	.346 sec.	c> b and a (7);	a=b=c (2); a> c and b (5)		?	
(2) .366 "	.354 "	.436 "	.079 "	.075 "	.33 "	c> b> a (2);	c> a> b (4);	b> c> a (3)		
(3) .535 "	.516 "	.7 "	.123 "	.119 "	.473 "	c> b> a (3); c> b and a (8); c> a> b (1)				
(4) .566 "	.58 "	.533 "	.114 "	.1 "	.515 "	c> b> a (3); c> b and a (10); c> a> b (3); a=b=c (1)				
(5) .622 "	.65 "	.773 "	.064 "	.068 "	.31 "	c> b and a (5);	c=b=a (1)		(a) 304.16 vib.; (b) 300 vib.; (c) 362.6 vib.	

TABLE XXXIX.—H.

TIME.						INTENSITY.			PITCH.	
Syllable.			Pause.							
(a)	(b)	(c)	(a)	(b)	(c)					
(1) .348 sec.	.325 sec.	.275 sec.	.132 sec.	.128 sec.	.246 sec.	Not clear.				
(2) .363 "	.332 "	.316 "	.111 "	.105 "	.183 "	c> b and a (9)				
(3) .36 "	.364 "	.396 "	.152 "	.114 "	.167 "	c> b and a (5); c> a> b (1); a> and c> b (2)				
(4) .404 "	.377 "	.322 "	.125 "	.122 "	.213 "	c> b> a (3); c> b and a (9)				
(5) .45 "	.343 "	.359 "	.118 "	.123 "	.23 "	c> b and a (10)				
(6) .343 "	.321 "	.331 "	.089 "	.103 "	.143 "	c> b and a (13)			(a) 298 vib.; (b) 318.3 vib.; (c) 357.7 vib.	

TABLE XL.—R. A.

TIME.						INTENSITY.			PITCH.	
Syllable.			Pause.							
(a)	(b)	(c)	(a)	(b)	(b)					
(1) .307 sec.	.288 sec.	.446 sec.	.321 sec.	.414 sec.	.576 sec.	c> b and a (1);	c=b=a (6)		No pitch difference.	
(2) .283 "	.253 "	.536 "	.294 "	.33 "	.489 "	Not clear.			" " "	
(3) .368 "	.346 "	.432 "	.318 "	.328 "	.642 "		c=b=a (4); a> b and c (3)		" " "	
(4) .454 "	.446 "	.517 "	.332 "	.346 "	.596 "	Not clear.			" " "	
(5) .489 "	.491 "	.491 "	.36 "	.346 "	.659 "		c=b=c (6); a> b and c (1)		" " "	
(6) .55 "	.57 "	.58 "	.415 "	.41 "	.795 "		c=b=a (4); a> b and c (1)			
(7) .616 "	.633 "	.65 "	.4 "	.404 "	.529 "		a and b> c (4);	a> b and c (2)		



observed gave the curious arrangement . Cf. section on Pitch.

The frequent inversion in the reading of all three, the tendency of *R. A.* to pass over to an entirely unmodified or primary rhythm, and the conflicts between (or absence of) differentiating marks in the readings of *H.* and *C. D.*, point to an inherent difficulty in the anapaestic arrangement.

§ 3. SUMMARY.

Two main problems now present themselves. (1) We must enquire into the arrangement of the different rhythmical forms in order of psychological complexity, using the facts brought out in the experiment as a basis for classification and finding, if we can, an adequate psychological explanation for this order. (2) We must collate the data with reference to the objective factors which determine the grouping, and consider their meaning for consciousness.

1. Does the order of increasing difficulty run parallel with that of increasing rhythmical perfection,—rhythmical perfection connoting unitariness of impression for the hearing subject? The predominance of the primary grouping in the free reading of the younger children would indicate a separateness of each syllable or impression in the early consciousness. There are several forms in which a tendency towards a primary rhythm can be discovered in the restrained readings of the same children. It appears in the form of equal pauses, regularly recurring after each syllable,—although these syllables differ regularly among themselves, as to duration, intensity, or pitch; again, in a rhythm of the same character as the former, but lacking the *regular* recurrence of differences,—one syllable being raised above the other at *irregular* intervals; and, finally, in the primary rhythm in which the syllables do not differ perceptibly as to duration, intensity or pitch. These appear to be retrogressive stages which the complex forms undergo, resulting in a gradual loss of their unitary character through the fading out of their distinctive marks; till at last the primary form, the simple, disconnected, although regular succession of one sensation after another is reached. The result seems to be due to a gradual blunting of the sensible discrimination, a blunting which at times is objectively conditioned by the slow rate of succession. A comparison of two syllables, relatively easy when the syllables succeeded each other at such a rate that both fell within the limits of immediate time perception, would be more difficult at a slower rate of succession. Why, then, does this slow rate of succession appear? It follows both from the inability to attend to more than one syllable at a time, *i. e.*, from an extreme narrowness of the range of attention;

and from the slowness with which the attention of the young child functionates, *i. e.*, the longer time necessary to bring any impression into the focus of attention. This retardation doubtless arises through lack of inhibitory control. These facts are shown more clearly in the Tables for the time of a whole series. [Tables XLII (a) and (b).]

Under experimental conditions, the strained attention of adults has been found to cover forty impressions succeeding one another at a rate of from .2 to .3 sec.; but these results, representing as they do the maximal value for trained adults, cannot be approximated in the case of children. Moreover, in the figures given by Wundt¹ the range does not exceed five *units* (each unit containing eight beats) or eight units (each unit containing two beats). An *unit* made up of several impressions is nearly as readily perceived as the simple uncompounded unit; this is of course dependent upon the completeness of unity. Bolton's Subject 9 found that he could not hold more than eight or nine clicks together. Apparently, the range of attention for adults does not exceed eight separate units; with the young child one or at best two *separate* impressions or units seem to be the limit.

The errors arising from the reading of the different restrained forms by Method I, made as they were by so many individuals, have considerable weight in settling the question of the psychological priority of the two over the three grouping. For that reason they have been brought together in tabular form. They are errors in the sense that they are deviations from the normal manner of reading and are due to inversions of one or all of the objective determinants of rhythm, or to general irregularities.

TABLE XLII.
First Grade.

Germans. 35 Readings.	Americans. 46 Readings.
Trochee, 1 failure.	17 failures.
Iambus, 12 "	22 "
Dactyl, 4 "	24 "
Anapest, 15 "	33 "

Fourth Grade.

Germans. 41 Readings.	Americans. 43 Readings.
Trochee, 4 failures.	0 failures.
Iambus, 4 "	15 "
Dactyl, 1 "	4 "
Anapest, 3 "	12 "

¹ Outlines, Eng. Translation, pp. 214 ff.

Seventh Grade.

Germans. 49 Readings.		Americans. 39 Readings.	
Trochee,	1 failure.		3 failures.
Iambus,	7 "	6 "	
Dactyl,	2 "	5 "	
Anapæst,	2 "	7 "	

The American boys of the first grade and three of the girls failed in every attempt to produce the dactyl and anapæst. The preference for (and priority of) the two over the three group has been brought out in nearly all of the investigations that have touched upon the question. Miss Smith¹ reports an apparent exception, in which the subject always chose a three-grouping; but it is to be remembered that not only was the subject an adult, who had doubtless made some strong association with the three-grouping, but the purpose of the experiment was the investigation of the effects of the different rhythms upon the memorizing of nonsense syllables. It can be readily understood that the three-grouping, because it broke the total number of impressions into fewer unities, might be more advantageous for memorizing than a two-grouping; this instance cannot therefore be regarded as an exception to the rule that the two-group is psychologically simpler than the three-group. Kuelpe² accounts for the greater ease with which even numbers of impressions are compared than odd by the natural tendency to a two-grouping, although he does not explain this tendency. Bolton's³ subjects had the prevailing tendency to group by twos or fours (which latter is merely a doubling of the two-grouping). In our later experiments with adults on the influence of pitch variations, whenever there was no objective difference between the sounds and subjective grouping took place, the grouping was always by twos or multiples of two. The three-grouping, which Bolton was able to suggest to a few subjects did not once occur with ours, although series of equal sounds were alternated in every experiment with series that were objectively grouped in threes. This suggestion should have been strong enough to have brought about a three-grouping, if mere suggestion was sufficient. Lanier⁴ says: "I think no subject in the history of æsthetics is so curious as the overpowering passion of the English ear for a three rhythm [the two-group] as opposed to the four rhythm" [the three-group]. From our father Caedmon through all the wonderful list down

¹ *Op. cit.*, p. 217.

² *Grundriss der Psychologie*, 1893, p. 409.

³ *Op. cit.*, p. 216.

⁴ *Op. cit.*, p. 41.

to the present day, every long poem and nearly every important short poem in the English language has been written in some form of the three rhythm" [the two-group].¹

There can be no question but that the two-group is psychologically prior to the three-group. Why should this be the case? Numerous answers are given. Some explain that the two-group falls within the bounds of the natural period of attention. But the three-group has a shorter duration than the two, and would therefore more certainly fall within the required bounds. An explanation in harmony with Buecher's theory must seek to derive the fact of a psychological simplicity of the two-rhythm from its more frequent use in the work of primitive man. Others explain this preference for the two-rhythm as due to its accordance with the bodily rhythms, the expiration and inspiration of respiration, the diastole and systole of the heart, and the swing of the right and left leg in walking.

There is no one principle which satisfactorily explains the preference for the two-rhythm; but there are both psychological and physiological grounds for this preference. That we can think (and use in practical life) a large variety of combinations; while we are, as a matter of fact, restricted to some form of two or three grouping, or their multiples, in rhythmical combinations; is due, we may suppose, to the relativity of our sensible discrimination for intensities. At most we can directly compare but three, and two intensities are compared with greater ease and exactness. This, then, gives us one reason for the preference of the two-rhythm. Moreover, a two-grouping is reinforced by all of the bodily rhythms which fall into unison with any two-rhythm. Thus what is psychologically most simple is also most in harmony with the physiological mechanism.

Is one form of the two-rhythm psychologically more simple than another? Does the accent fall on the last syllable as readily as on the first? The experimental results would indicate, especially in the case of the younger children, that the accent falls most naturally on the first syllable: *cf.* the great number of cases in which, when the iambic reading was required, the trochaic was given. Other results, beside the proportion of failures in the trochaic and iambic readings, point to the earlier perfection of the trochaic; temporal subordination was not as marked in the case of the iambus as in that of the trochee. There were also a greater number of temporal inversions. The first grade, in their attempt to render the iambus,

¹ Lanier used a peculiar notation based upon the musical: the trochee and iambus have according to this notation three time units, the long (equal to two short) *plus* a short.

reverted very frequently to a grouping characterized only by the pause (either in the form of the primary rhythm or of the spondee). The pitch intervals for the iambus were smaller than for the trochee, and intensity differentiations were also less frequent. Both often decreased in the course of the reading; this no doubt was the result of the gradual withdrawal of the attention from its unnatural position on the second syllable, and in the cases of complete inversion to focusing of the attention on the first syllable of the group. Wundt¹ regards the iambus and trochee as equally simple psychologically; but in the face of experimental facts to the contrary his view can hardly be maintained. Bolton² found that the first sound in the two grouping was accented. The second could be accented by suggestion, but no subjects would agree that it was the natural accent. The experiments show, however, that the great difference between the ease and correctness with which the trochee and iambus are rendered decreases with increasing years, until a few children of the fourth and seventh grades appeared to prefer this grouping. Meumann,³ although he agrees with Wundt as to the simplicity of the iambus, gives us a partial explanation for the trochaic being the more natural grouping. "Central adaptation is more rapid when the first introduction of a rhythmical motive is powerful." Thus the strengthening of the first part of the foot gives any grouping a greater efficacy for reproduction. Ettlinger,⁴ who regards accent as due to the influence of a backward moving force in its inhibition of the forward, finds the trochaic the most natural grouping because the influence of the inhibitory force is strongest immediately after the pause. When Ettlinger's theory is put in terms of attention, the explanation of the natural preference of the trochee is that the first sound following the pause receives, by virtue of contrast with silence, greater attention than the second sound. Thus, even when not objectively accented, it receives a subjective stress as a result of the clearness with which it is focused by the attention.

Riemann⁵ derived the three-group from what he considered the most perfect form of the two-group,—one in which the long was equal to two short. These three equal time units are the basis for the three-grouping. But this is not necessarily the most perfect form of the two-group. On the contrary, the proportion of two to one does not seem to be natural (*cf.* Tables).

¹ *Grundzüge*, II, p. 86.

² *Op. cit.*, p. 222.

³ *Op. cit.*, p. 299.

⁴ *Zur Grundlegung einer Ästhetik des Rhythmus*, *Zeitschrift*, XXII, p. 187.

⁵ *Musik-Lexicon*, Article *Metrik* (quoted by Meumann).

The time relations as shown by the experiment were not so simple as Riemann's theory would lead us to expect. And it is not necessary to derive the three group from the two; it is more probably an original form, as original as the other.

The experimental results point conclusively to the priority of the dactylic form. The difference in number of errors in the readings by the younger children of the dactyl and anapæst was marked. The anapæst was far more frequently inverted and given as a dactyl, than the dactyl as anapæst. Bolton's subjects heard the first sound in the three-grouping as strongly accented. Occasionally, a subject found it easier to accent the second more than the first, but this did not seem to be the natural way. The reason given above for the preference of the trochee over the iambus would hold for the preference of the dactyl over the anapæst.

The process of inversion was best illustrated in anapaestic grouping; it was also much more frequent here. A peculiar arrangement of intensities which Ettlinger¹ cites in an altogether different reference can be best explained as a stage in the process of inversion. He affirms with Riemann that the greater intensity comes at the beginning and not at the end of the long syllable. Thus a grouping $\text{U} \ \underline{\underline{\text{U}}} \text{ } \text{U} \ \text{U} \ \underline{\underline{\text{U}}}$ and $\text{U} \ \text{U} \ \underline{\underline{\text{U}}} \text{ } \text{U}$ in the form

could arise from a strong tendency to give the first sound the greater intensity. These forms, in which temporal and intensive relations are in conflict, are not stable or regular forms, as Ettlinger seems to regard them. They are undoubtedly first stages in the process of inversion, which, if the rhythm were continued long enough, would finally give the more natural arrangement of the dactyl, in which the greatest intensity and duration are given to the same sound. Such forms as these frequently occurred in the rendering of the iambus and anapæst by the children, and were always then considered as cases of partial inversion. This also agrees with our observation that pitch and intensity are less stable than time; when inversion is not complete, pitch and intensity are the first to become inverted,—the accent then passing over to the first syllable,—while the temporal arrangement, being more stable, remains as at first; although it, as a rule, also shifted, if the rhythm were continued long enough, until the longest and strongest were no longer in opposition. Another and more common form of inversion, in which the temporal and intensive arrangement shifted at the same time, was apparently effected by a gradual change in the position of the pause; at no time in the process was there a conflict between the

¹ *Op. cit.*, p. 183.

intensive and temporal order. Eberhardt¹ has reported a similar occurrence: with the form $\text{P P P} \dot{\text{P}} | \text{P P P} \dot{\text{P}} |$ or $\text{P} \dot{\text{P}} \text{P} | \text{P} \dot{\text{P}} \text{P} |$

long repeated, the form $\dot{\text{P}} \text{P P} | \dot{\text{P}} \text{P P} |$ resulted. "Bei sehr langsamem Rhythmen verschwindet dagegen die Zusammenfassung mehr und mehr; an die Stelle der Trennung der Gruppen tritt ein allmähliches Uebergehen von der einen Gruppe zur anderen, vermittelt durch das letzte Glied jeder Gruppe, auf; das letzte Glied wird dann als Auftakt angesehen und als solcher enger mit dem ersten Glied der nächsten Gruppe verbunden."

The form which Wundt² considers the earliest three grouping (the amphibrach) was never observed during the course of the experiment, either with children or adults; although, particularly with the adults, the possibility of such an arrangement was given, as will be seen in the later discussion of the method used. For this reason a special investigation with twenty-eight seventh grade children was made, in which this form among others was directly requested. The children were asked to emphasize the second and fifth syllable on each line. With one exception they invariably declared, before reaching the end of the first line, that they were unable to read it in that way, and being asked to try again threw the five lines either into a form something like this $\text{---} | \text{---} | \text{---} | \text{---} | \text{---} |$. Often, by avoiding a pause at the end of a line, they were able after a line or two to give the remainder entirely in a dactylic or anapaestic rhythm. Some could find no rhythm, and the result was a perfectly irregular rendering, with an occasional syllable louder and longer than the others. One child out of twenty-eight, a girl of twelve, gave the grouping without the slightest hesitation. She read unusually rapidly and in an animated manner. It might be conjectured that the children failed on this form because they had already practiced the other forms; but for this experiment children were selected who knew nothing of the previous experiment, in order that the effect of practice should not prejudice the results. The usual proportion of inversions was noted in the reading of the other forms. But even then, the disparity between the results for the anapæst (the most difficult of the three group), with four inversions out of twenty-eight readings, and the amphibrach with twenty-seven failures out of twenty-eight readings, proves conclusively the artificial and unnatural character of the latter grouping.

¹ Zwei Beiträge zur Psychologie des Rhythmus u. des Tempo. Zeitsch. für Psy., XVIII, p. 126.

² Grundzüge der physiol. Psych., 1893, 4te Aufl., II, p. 86.

The results so far obtained are not in harmony with Miss Smith's statement¹ that there is no such thing as a poor rhythm; that rhythm either is present as a complete and perfect form, or vanishes entirely. There are, on the contrary, several clearly defined stages or degrees of rhythmical perfection or unitariness. While E. A. Poe, in his *Rationale of English Verse*, derives rhythm from an improbable source (the pleasure due to equalities; the simple ear preferring simple equalities, the practiced compound equalities), his order of genesis agrees in several particulars with that which the results of the experiment have led us to make. Poe regarded the rudimentary form of verse as the spondee; later came a collection of two spondees; a third step was the juxtaposition of three words; and monotony finally led to the employment of accent. But the experiments seem to indicate (1) that the earliest rhythm is even simpler than the two-group of Poe; that what has been termed the primary rhythm is the simplest and earliest form. (a) This is modified by the introduction of irregularly recurring accents. Boehme considers this the characteristic arrangement of children's verse.² "Das Kind kennt (wie das Volk) in seiner Dichtung kein jambisches oder trochäisches Versmass, sondern zählt bloss die Hebungen, d. h., die betonten Silben in jeder Zeile; zwischen die Hebungen treten dann die Senkungen (die unbetonten Silben), je eine, oder zwei oder keine, denn die Senkung darf auch fehlen. Herrschend tritt ins Kindereim das sogenannte trochäische Mass auf."

(2) Next in order comes the simplest two-group, the spondee; two syllables of equal intensity, duration and pitch, separated from the two following by a longer pause than that intervening between each pair of syllables. (a) A trochaic arrangement of the variants, *i. e.*, the accent on the first syllable. This has a number of possible degrees of perfection; in its completest form the last syllable would be subordinated to the first, not only in intensity, but also in duration and in pitch. (b) The second syllable accented or iambic arrangement of the variants. There is considerable variation in the results; for some the dactyl is undoubtedly easier than the iambus, but on the whole we should probably be justified in regarding the iambus as naturally preceding the dactyl.

(3) The three-group. The unaccented form is very rare; it is questionable if the group ever occurs without the presence of a very slight accent upon one syllable. (a) The dactyl is undoubtedly the simplest three-rhythm. (b) The anapaest comes next to the dactyl in order of difficulty. (c) The form

¹ *Op. cit.*, p. 292.

² *Deutsches Kinderlied und Kinderspiel*, Leipzig, 1897, p. 8.

which Wundt regards as the original form of the three-group, if admitted at all, must be regarded as the most difficult. These are all three capable of great variety in arrangement through variations of the different objective factors.

2. THE OBJECTIVE FACTORS: THEIR ARRANGEMENT AND ITS SIGNIFICANCE.

To the mooted question of the importance of a temporal factor in rhythm, Lanier¹ replied that "primordial temporalness is always necessary," and again: "the office of accent cannot begin until after rhythm is established; when accent may be used to suggest various secondary arrangements of the primary rhythmic material; but this office is still absolutely dependent upon time or duration, the sole use of accent being that it recurs at stated intervals of time." Certain poetry, as Tennyson's "Break, break," is dependent for its effect upon measured silences, and must therefore be clearly independent of accent. "If the rhythm were struck by a machine incapable of intensity or pitch difference the rhythm would still be pleasing." Ettlinger² states that the order of grouping is always dominated by the temporal factor. These statements of Lanier and Ettlinger are quite different in their bearing. 'Primordial temporalness,' or in other words regularity of succession, characterizes even the simplest or the primary rhythm. Without it perception of rhythm fails (although Miss Smith³ has shown that slight objective irregularities do not disturb the rhythm, she does not prove that subjective regularity of impressions was not present). Temporalness, in its connotation of regular succession, is the basal principle of rhythm. This, however, is quite another thing than saying that the character of the grouping is dependent upon the time order. Temporal changes can alone (intensity and pitch remaining constant) produce a pleasing rhythm, as has been shown in the results of the experiments; but intensive co-ordination (the temporal relations remaining constant) can also produce a rhythm. When time and intensity conflict, for example, when the shorter is the stronger, it is a question whether the long or the strong syllable will dominate the grouping. The results of the experiments on pitch would indicate that under certain conditions the objectively long may appear shorter and unaccented. Meumann says⁴ that the long syllable because of its greater volume of sound draws the attention to it, and is therefore fitted to introduce a subjective accent. On the other hand, it is equally true

¹ *Op. cit.*, pp. 65, 103, 101.

² *Op. cit.*, p. 182.

³ *Op. cit.*, p. 123.

⁴ *Op. cit.*, p. 404.

that the objectively strong syllable, by virtue of that fact, is focused by the attention and receives a subjective accent. It would seem as if any change, either temporal or intensive, by the very fact of change and through the increased attention which it consequently receives, can bring about a subjective accent or stress. Then the factor, which is best suited to emphasize the fact of change, must have the greatest influence upon the character of the rhythm. Neither time nor intensity, as such, is a determinant of secondary rhythm; but either may be this when translated into terms of subjective accent or stress (*q. further discussion*).

Position of pause. When several groups were compounded, a short interval followed each group, while a much longer interval followed the compounded group. The long pause with our subjects, as the synchronous readings from the microphone and pneumograph show, always occurred at the time of inhalation. The end of a group was marked by a pause longer than that which separated the syllables of the group. In the dactylic and trochaic grouping, this is the pause preceding the accented syllable. But the interval preceding the accented syllable in the iambic-anapaestic grouping was not always lengthened; although frequently a secondary pause occurred after the accented syllable in the case of the dactyl and before it in the anapaest. In the three-group, the two intervening pauses were ordinarily of the same length. There was still another arrangement noticed in the microphone readings; the first pause was shortest, the second longer, and the third longest. Several orders were observed, in the dactyl —
—, — — —, — — —; and in the anapaest, — — —, — — —. The second form gave a more unitary character to the whole group. It is the only order which Wundt¹ recognizes. "If in a long series of regular beats, single impressions are emphasized by their greater intensity or by some qualitative peculiarity, one uniform result is the overestimation of the interval preceding and following the emphasized beat." This lengthening is brought about through expectation and relief.—We cannot find Wundt's explanation satisfactory. For (1) at the rate at which sounds must follow each other to produce a rhythmical impression expectation and relief could play no part. Eberhardt² also says that expectation was never present according to his introspection when the rate of succession was less than one second, and then only occasionally present. (2) The arrangement of pauses, which this theory presupposes, is not by any means the

¹ Outlines, Eng. Trans., p. 150.

² *Op. cit.*, p. 109.

only one found, as has already been shown. The long pause occurred most frequently at the end of the group only, the intervening pauses being of nearly the same length. The lengthening of the pause appears rather to be conditioned by the changing of the attention; in the shifting of the attention from one sound to another there must be a psychologically empty time which we call a pause. The apparent lengthening of the pause following the accented syllable is a contrast effect between strong sound and succeeding silence.

Order of syllables. This was not constant. The different arrangements were correlated with clearly defined grades of unitariness in the total impression. In the dactylic grouping, with the microphone reading, the most frequent order was — — — ; *i. e.*, the duration of the syllables gradually decreases. In the freer renderings of Method I the order was — — — ; the second and third syllables were of equal duration. The order — — —, in which the first was still equal to the sum of the second and third, but the second was shorter than the third, was frequently given. The order noted by McKay and Hurst¹ is the same as that which occurred most frequently in the microphone readings; this appears, on the whole, to be the least perfect arrangement; Meumann and Eberhardt give the order which has been noted as the least frequent but the most perfect. Bolton's² rule for the time order of a group of sounds is not substantiated by the results either with children or adults. His principle is that "a longer sound occurring regularly in a series imposes a grouping according to the number of sounds between the long ones. The long sound is as a rule the last in the group." The subjects must have confused the long sound and the long interval in their report.

Here, as in the ordering of the pause, the unitariness of the impression appears to be in proportion to the degree of contrast; thus the most unitary impression is given by the time order — — —. When a group of syllables follow each other in the order Bolton gives, the primary rhythm is still prominent; the separate syllables or sounds are not subordinated to the group, as they are in the grouping just noted. The time relation of the accented syllable to the unaccented was never the relation of two to one, nor could it be expressed by simple numbers: *cf.* Tables. As a rule the accented syllable was but slightly longer than the unaccented. Neither did Wrinch and Shaw³ find the definite time relations $\frac{1}{2}$ and $\frac{1}{4}$ as

¹ Experiments on Time Relations of Poetical Metres, Univ. of Toronto Studies, No. 3.

² *Op. cit.*, p. 231.

³ Contributions to the Psychology of Time, Univ. of Toronto Studies, No. 2, p. 51.

they appear in musical composition. These results are not in accordance with Mach's statement:¹ "So far as I am able to judge, we recognize the identity of time ratios of two rhythms only when they are capable of being represented by very small numbers. Thus we really notice, immediately, only the identity or non-identity of the two times, and in the latter case recognize the ratio of the two only by the fact that one part is exactly contained in the other. Herewith we have an explanation of the fact that, in marking time, the time is always divided into absolutely equal parts." The fact that an intensive change may be substituted for a temporal and the feeling of equality not disturbed argues against Mach's theory. The facts of substitution and the analogous case of the influence of limiting stimuli upon the judgment of short intervals (intervals bounded by strong stimuli are judged longer than equal intervals bounded by weak stimuli) indicates that what we have is not a direct comparison of times but one of subjective stresses.

The Relative Time Values of the Restrained Forms. The total time for reading thirty syllables, in accordance with the four required arrangements, was taken in Method I by means of a stop-watch. The microphone readings are not comparable, as the number of groups given in any one series was indefinite, depending upon the number that could be recorded in one revolution of the drum. Consequently only the results of the readings by Method I have been tabulated.

The figures given in Table XLII represent the average time of the different classes. The asterisk marks the absence of members. The absence of an individual affected the average, increasing or decreasing the time, according to the time of the individual in question; the absences therefore give a greater appearance of irregularity to the results than really existed.

American children. There is a decrease in time required for reading a series corresponding to the age of the pupil. With the boys this holds throughout, from the first to the seventh grade, the change being greatest between the first and the fourth grades. This is undoubtedly due to the slower functioning of the attention in the case of the younger children. The times of the girls of the fourth grade were faster than those for the seventh in the reading of the trochee and iambus. The natural reaction time of the girls of the fourth grade was faster than that of the seventh, but the greater difficulty of the dactyl and anapaest for the fourth grade girls made their time for the reading of those forms slower than that of the seventh grade. The *m. v.* is greatest for the first grade. The effect of practice is not marked, but is most noticeable in the case of

¹ *Analysis of Sensation*, Eng. Trans., p. 118.

INVOLUNTARY.

I.		IV.		
B.	G.	B.	G.	B.
31.5	34.	29.2	26.1	25.
26.2	33.5	21.7	21.	24.2
*27.5	26.	19.65	*21.8	20.6
27.4	30.6	19.2	20.1	22.9
27.8	28.4	21.1	*22.05	21.7
<hr/>		<hr/>		
28.08		22.17		22.2
M.V.		M.V.		M.V.
1.36		2.81		1.51
<hr/>		<hr/>		
30.5		22.41		
M.V.		M.V.		
2.64		1.43		

INVOLUNTARY.

I.		IV.		
B.	G.	B.	G.	B.
22.9	18.2	12.4	17.4	12.5
22.2	*17.3	13.9	16.9	*12.2
23.	18.2	14.3	*14.8	13.1
19.7	16.1	14.1	14.05	*12.1
21.6	15.6	15.1	13.3	13.
<hr/>		<hr/>		
21.88		13.96		12.5
M.V.		M.V.		M.V.
1.24		.64		.5
<hr/>		<hr/>		
17.08		15.29		
M.V.		M.V.		
.97		2.49		

TABLE XLII (a).
Average Times for Different Classes. German Children. Reading 30 Syllables.

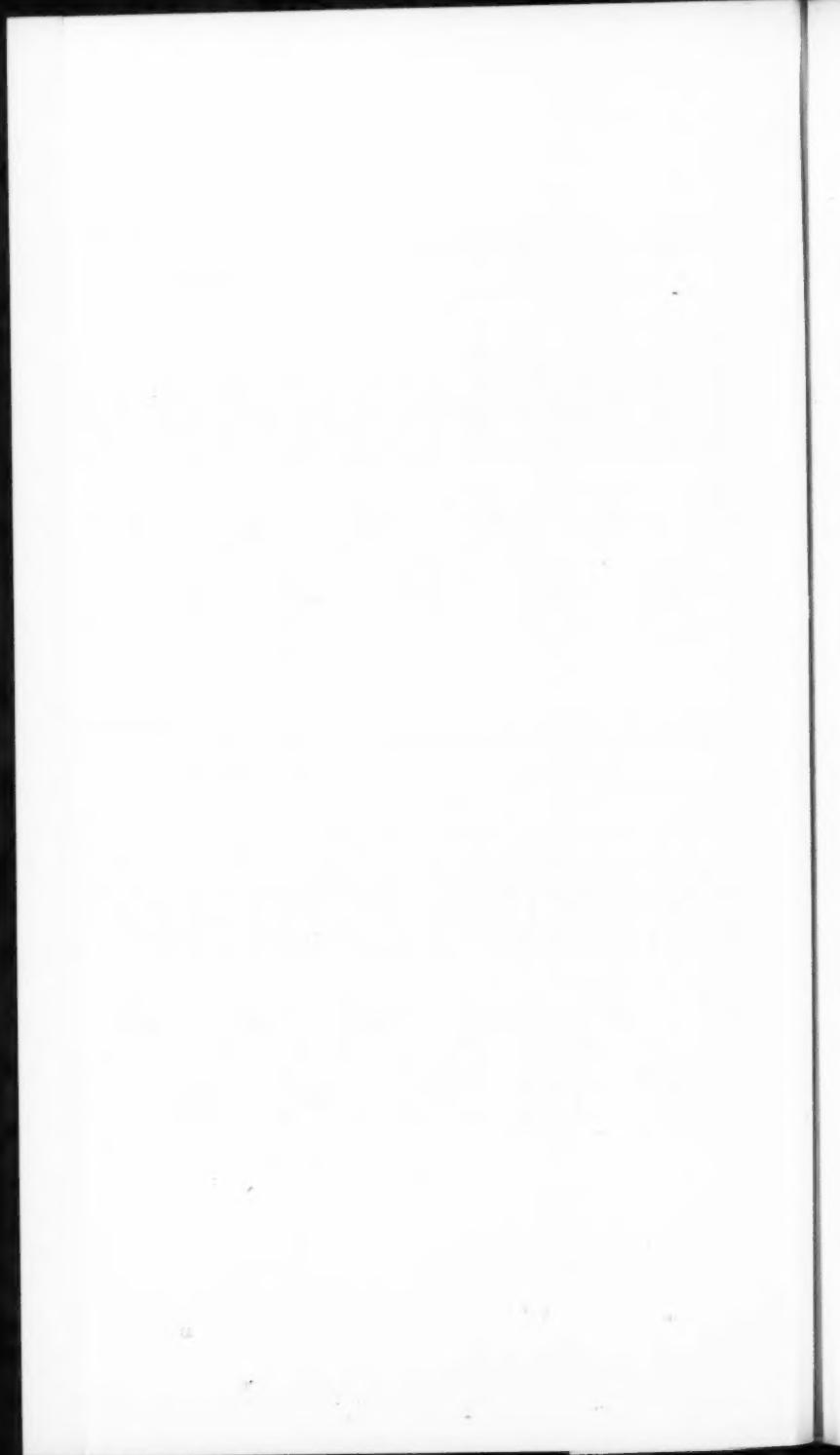
INVOLUNTARY.						TROCHEE.						IAMBUS.						DACTYL.						ANAPEST.						Rhythm.						
I.		IV.		VII.		I.		IV.		VII.		I.		IV.		VII.		I.		IV.		VII.		I.		IV.		VII.		Class.						
B.	G.	B.	G.	B.	G.	B.	G.	B.	G.	B.	G.	B.	G.	B.	G.	B.	G.	B.	G.	B.	G.	B.	G.	B.	G.	B.	G.	B.	G.							
31.5	34.	29.2	26.1	25.	20.8	31.5	31.3	25.8	22.8	25.	18.	28.7	24.3	23.8	22.6	19.8	21.	31.5	38.6	23.6	21.5	28.5	20.4	27.2	31.3	25.	20.5	21.	16.1							
26.2	33.5	21.7	21.	24.25	22.3	28.05	31.	22.9	20.2	21.75	18.1	28.05	34.06	22.3	22.2	21.9	19.4	32.25	30.3	21.	*19.84	21.2	20.6	*21.75	27.4	29.3	20.1	17.5	19.9	17.8	27.5	35.	22.85	18.	22.25	16.45
*27.5	26.	19.65	*21.8	20.6	22.5	*26.75	27.26	20.5	*22.5	22.8	20.96	*32.25	30.3	21.	*19.84	21.2	20.6	*21.75	27.3	18.05	*19.3	19.8	17.36	*24.25	30.66	18.75	*19.53	19.6	16.6							
27.4	30.6	19.2	20.1	22.9	21.8	28.2	32.7	20.2	21.4	21.5	18.76	27.4	31.7	19.5	20.7	22.1	18.7	25.9	29.3	19.3	16.9	19.6	17.1	27.5	30.	18.7	17.14	20.2	15.5							
27.8	28.4	21.1	*22.05	21.7	19.5	28.5	30.8	20.	*21.2	21.08	19.5	27.6	29.6	21.8	*21.	19.8	18.3	24.8	26.3	18.8	*17.	*15.8	15.6	24.1	30.	18.5	*17.6	*18.05	15.9							
28.08		22.17		22.29		28.6		21.88		22.42		28.8		21.68		20.96		26.27		19.97		20.72		26.11		20.76		20.62								
M.V.		M.V.		M.V.		M.V.		M.V.		M.V.		M.V.		M.V.		M.V.		M.V.		M.V.		M.V.		M.V.		M.V.		M.V.		M.V.		M.V.				
1.36		2.81		1.51		1.16		1.97		1.34		1.38		1.76		.93		2.55		1.48		2.22		1.56		2.53		1.2								
30.5		22.41		20.58		30.61		21.62		19.86		29.99		21.26		19.80		30.16		18.44		17.65		31.39		18.55		15.71		M.V.		1.17		.61		
M.V.		M.V.		M.V.		M.V.		M.V.		M.V.		M.V.		M.V.		M.V.		M.V.		M.V.		M.V.		M.V.		M.V.		M.V.		M.V.		M.V.				
2.64		1.43		.83		1.06		.65		1.03		2.97		.904		1.		3.34		1.57		1.13		.48												

*One member absent.

TABLE XLII (b).
Average Times for Different Classes. American Children. Reading 30 Syllables.

INVOLUNTARY.						TROCHEE.						IAMBUS.						DACTYL.						ANAPEST.						Rhythm.					
I.		IV.		VII.		I.		IV.		VII.		I.		IV.		VII.		I.		IV.		VII.		I.		IV.		VII.		Class.					
B.	G.	B.	G.	B.	G.	B.	G.	B.	G.	B.	G.	B.	G.	B.	G.	B.	G.	B.	G.	B.	G.	B.	G.	B.	G.	B.	G.	B.	G.						
22.9	18.2	12.4	17.4	12.5	16.1	23.02	23.1	15.4	23.1	14.45	18.8	30.4	22.3	16.7	19.7	14.2	18.8	29.5	22.4	16.1	19.3	13.2	16.5	30.7	22.	15.1	21.3	11.05	15.5						
22.2	*17.3	13.9	16.9	*12.2	15.6	24.7	*18.7	14.7	19.5	*12.7	19.1	26.7	*17.5	16.2	20.7	*13.1	16.8	28.3	*16.7	15.5	18.5	*12.	16.1	24.1	*20.	14.45	16.5	*11.5	15.1						
23.	18.2	14.3	*14.8	13.1	15.6	21.3	19.4	15.9	*16.9	13.	18.4	22.2	19.9	14.9	*17.5	13.9	18.3	22.5	18.6	14.1	*15.2	11.1	15.7	21.5	19.	13.5	*14.6	11.5	16.						
19.7	16.1	14.1	14.05	*12.1	17.2	20.9	17.9	*14.7	14.6	*13.5	19.	23.3	21.2	*15.2	16.05	*12.4	17.5	22.8	*16.9	*13.2	13.7	*12.	15.5	22.6	17.2	*14.6	13.8	*11.6	14.3						
21.6	15.6	15.1	13.3	13.	*16.3	24.1	21.	15.4	15.8	15.2	*17.3	23.3	20.4	15.2	17.5	14.5	*17.5	23.1	17.1	14.5	13.3	12.6	*16.	21.7	17.8	13.	14.1	12.6	*15.2						
21.88		13.96		12.88		22.8		15.2		13.7		25.1		15.6		13.6		25.24		14.6		12.2		24.1		14.13		11.65		M.V.		.38			
M.V.		M.V.		.56		M.V.		1.36		.42		M.V.		.64		.74		M.V.		.88		M.V.		.56		M.V.		.68							
1.24																																			
17.08		15.29		16.1		20.02		17.9		18.5		20.6		18.23		17.8		18.3		16.		15.96		19.2		16.06		15.2		M.V.		.42			
M.V.		M.V.		.46		M.V.		1.76		2.24		M.V.		1.22		1.31		.62		M.V.		1.76		2.3		.24		1.24		2.61		M.V.		.42	
.97		2.49		.46																															

*One member of class absent.



the girls. In the involuntary grouping of the boys of the fourth grade the rate of succession in the later series is slower than in the earlier. The reason may be that because of its great regularity it offered less and less interest. Throughout, the times for the boys of the seventh grades are faster than those for the girls of the same grades. The values given for the boys and girls of the first grade do not represent the time values for the dactyl and anapæst, as they failed to produce those rhythms. In general, then, the three-groups are shorter than the two.

German children. The time values are much slower than for the Americans. With the girls the decrease in time required runs parallel with increase in age, but with the boys (excepting for the anapest and iambus) the fourth grade read more rapidly than the seventh. The effect of practice is greatest in the cases of dactyl and anapæst. The results are not so unequivocal as with the American children. The three-groups are slightly shorter than the two-groups.

These results, as far as they go, are in harmony with the results obtained by other investigators. The inherent difficulty of the more complex forms for the younger children obscured the general principle. For a satisfactory comparison of the time values of the different rhythms, the investigation must be carried on with adults. It is, however, clearly shown that the times for the three-groups are shorter than those for the two-groups. The three-group divides the series of sounds into fewer unities and naturally shortens the time for the total series. Within certain limits the number of sounds in a group appears to depend upon the rate of succession. Bolton's Subject 2 says: "Slower than a certain rate no rhythm is felt. With more rapid rates two clicks form a group. Faster still four clicks form a group with the primary accent on the first, the secondary on the third, and an interval after the fourth; a still more rapid rate gives an eight group. At some rates I was able to get a three rhythm accented strongly on the first."

The fluctuation in results will not warrant a comparison of the results for trochee and iambus or for dactyl and anapæst. Hurst and McKay¹ found that the foot in the iambus and anapæst tended to be longer than that in the trochee and the dactyl; that the trochee and dactyl were therefore used more frequently for stirring and rapidly moving verse. Rate of succession had a similar effect upon several of our subjects, who in comparing the two and the three group discs found that the three-grouped (rate of succession being more rapid) were enlivening and exciting, while the two-grouped were dull. "With fast rates intensive changes recur more rapidly and hence call

¹ *Op. cit.*, pp. 166 ff.

for more rapid muscular movement. On this account fast rates were found to be exhilarating and animating, and slower drowsy and soporific." If expectation played any part in mediating the grouping, we should expect the iambus and anapaest to be shorter than the trochee and dactyl. That the opposite is the case is an argument against the expectation theory of Wundt.

Arrangement of Intensities. In the two-group the strongest and longest naturally come first. They can, however, have a second place. Only in cases of partial inversion are the longest and strongest separated. The lengthening of the accented syllable follows naturally from the greater muscular strain and increased attention which are given it. In the three-group (dactyl) there were several arrangements given dependent upon the more or less perfect subordination of parts within the group. The forms noted were (a) _____, _____ or (b) _____, _____ or (c) _____, _____." The arrangement (a) was very frequent, (b) less frequent; the most satisfactory form was (c). These results do not agree with those of Bolton,¹ who notes only form (b), and gives as a principle that, when series of impressions made up of three or four intensities recur in a sequence, they are so arranged that the impressions are subordinated to one another as nearly as possible from beginning to end. Bolton also finds four arrangements of intensities possible; but it is very doubtful if we can directly compare more than three intensities, and can therefore have more than three grades of accentuation in a group. Eberhardt² does not find the arrangement Bolton gives; on the contrary, he notes arrangement (c) as the most natural form of the three-grouping. This is certainly a closer grouping, and gives an impression of greater unity than form (b). In it, the first is accented by contrast with the second and the third by contrast with the second, and the whole group appears to form a closed circuit; while in the last form there is a feeling that there might be still another step in the graded series before the end is reached. In other words, the subordination of the whole group to the accented syllable is greater by this arrangement.

Pitch Relations.

The question now presents itself whether quality can be

¹ *Op. cit.*, p. 226.

² *Op. cit.*, p. 123. "Ferner sei über das Betonungsverhältnis des zweiten und dritten Gliedes bemerkt, dass die von der Metrik verlangte Betonung des zweiten Schlages gegenüber dem dritten nicht stattgeunden hat; im Gegentheil scheint es, als werde stets der dritte Schlag minimal stärker betont als der zweite, wenn auch die Zahlen die dann vielleicht zu erwartende Verlängerung des dritten Gliedes nicht durchgehends aufweisen."

called a determinant of rhythm in the same way and with the same degree of constancy as time and intensity, or whether it merely increases the intensive effect. As previously noted, the more frequent occurrence of P. and I. together, rather than P. and T., might be so interpreted. Meumann appears to be of this opinion.¹ "Accent is, finally, never a mere increase in intensity but also an increase in pitch; increase of pitch as well as of intensity appears to serve the purpose of bringing out the logically and emotionally more important." The stronger and longer tone was nearly always the higher in the spoken rhythm, though there were many more cases of inversion in pitch than in either time or intensity. Several children always spoke of the stronger tone as the higher (this was without suggestion on our part, and the remark was always left apparently unnoticed). Not infrequently the longer, higher and stronger was accompanied by a raising of the whole body. Meumann also remarks that high notes are apparently more intensive than low notes of the same intensity. A contrary statement is made by Abraham and Schaefer.² "Wie für die Analyse des Akkordes, so wurde auch für die Bestimmung des Rhythmus der tiefste Ton unwilkürlich als erster Ton gewählt, wohl in Folge musikalischer Gewohnheiten. Er schien stärker aus der Tonfolge herauszuspringen, so dass es Mühe machte, mit einem andern den Rhythmus beginnen zu lassen." There appear to be three possible interpretations of the facts; either pitch is not an independent determinant of rhythm; or, being such, the higher is the accented; or again, in accordance with Abraham and Schaefer, the lower is the accented tone. In order to gain a more satisfactory answer, another series of experiments was made. The first experiment gave the qualitative relations of the motor rhythm only; the object of the second was to determine qualitative relations in a sensory rhythm, to determine whether the higher and lower tones had a constant position in the grouping, or if their position was dependent upon some secondary factor. It was necessary for such an investigation to get a series of tones that should vary only in pitch. For this purpose an apparatus was devised in the psychological laboratory at Cornell University.

Apparatus. Two electrically driven forks cased in sound proof boxes were the source of sound. At first the c^1 of 256 and the c^2 of 512 double vibrations were used; but the interval was too large to be satisfactory, and the a^1 of 435 was substituted for the c^1 of 256. A resonator was placed just above each tuning fork. Rubber tubes led out from these resonators, and ended at some distance from the boxes in small

¹ *Op. cit.*, p. 402.

² Ueber die maximale Geschwindigkeit von Tonfolgen: *Zeits. für Psy.*, XX, p. 415.

pieces of glass tubing, which were securely fastened to two wooden standards. In front of these standards discs were revolved. On the opposite side of the discs, a^1 and c^2 resonators were adjusted so as to catch their respective tones; by means of tubing the tones were carried to the ear of the subject. Nine discs were used. *Disc (1)*. For comparison of subjective rhythm—if the subjects were so inclined—with the rhythms objectively caused by variations in pitch, this disc had two circular slots 90° long, $1\frac{1}{2}$ cm. wide and 13 cm. from the center of the disc. These were on opposite sides of the disc. Thus the disc shut off the tone coming from the c^2 fork, allowing only that from the a^1 to pass through; as the tone was successively given and cut off, for an interval equal to the time required for the disc to make one-fourth of a revolution, the successive tones and intervals were of equal duration. *Disc (2)* had two slots, one of which was 4 cm., the other 13 cm., from the center of the disc. Each of these formed an arc of 90° ; and the successive sounds and silences were of equal duration, but varied in pitch. *Disc (5)* was made for the comparison of the subjective rhythm with the objectively conditioned three-group. It had three slots of 60° each, 13 cm. from the center of disc. *Disc (6)* had three slots, two of which were 13 cm. and the third 4 cm. from the center. It thus gave two tones from the a^1 fork to one from the c^2 . The duration of all the tones and intervals was equal, lasting for an interval equal to the time occupied by the rotation of the disc through 60° . *Disc (7)* had three slots; two 4 cm., one 13 cm., from the center. All arcs of 60° . The resulting rhythm was objectively composed of two tones from the c^2 fork and one from the a^1 ; these were of equal duration together with the intervening intervals. In order to ascertain if an increase in duration of one of the tones would change the rhythm already established, in *disc (3)* the slot admitting tones from the a^1 fork was increased, at first by an increment of 30° . Later 15° more were added. The resulting rhythm consisted objectively of two tones, that from the a^1 fork being one-half again as long as that from the c^2 . *Disc (4)*. The same number of degrees was added to the slot admitting tones from the c^2 fork. The resulting rhythm was a two-group, the reverse of that given by *disc (3)*. *Discs (8) and (9)*. The slots admitting the tones from the a^1 and c^2 forks respectively were increased at first by increments of 15° ; later 15° more were added. The resulting rhythms were three-groups, in which one tone was longer than the other two.

The time occupied by one rotation of a disc was approximately one second. The chief difficulty with the above apparatus or with any, for that matter, which might be devised, was in the regulation of the intensities of the two forks. There was no means of objectively regulating the intensities; recourse for that reason must be had to a subjective regulation. This necessitated a preliminary experiment for each series.

Preliminary Experiment. The subject sat with back to apparatus and experimenter, and at some distance from the resonator. In order to avoid all suggestion of rhythm in getting the intensity judgments, the discs were not used. Instead, at the first signal one tone was given for three seconds, at another signal the other tone was given for an equal time; and judgment as to the intensity of the two tones was passed. After a few preliminary judgments (to ascertain the nature and direction of difference), it was possible by increasing or de-

creasing the amount of resistance to the current as the judgments might indicate, to reach a nearly liminal difference. The method of procedure was then in the main that of Right and Wrong Cases. When evidence was given, through constancy in the direction of judgment, that there was subjective difference in intensity, the resistance was slightly increased or diminished in accordance with the direction of judgment. This procedure was kept up until a series of thirty judgments was obtained, in which there was either no constancy in the judgment, or both tones was judged equal. This result warranted the presumption that there was no subjective difference in intensity. Nearly all the subjects experienced great difficulty, when giving their judgments, in abstracting intensity from quality. Some judged the higher tones as "nearer" and therefore louder; others the lower tones as "bigger" and consequently louder. For this reason the two forks first used were very unsatisfactory; with an interval of a minor third the difficulty was not so great, and near the limen a few of the subjects, who were decidedly unmusical, confused the pitch of the two tones as well.

Having then the conditions for the experiment (equality in time and intensity), we proceeded to use the discs. Sometimes the two-grouped were given first, at other times the three-grouped. Discs 1 and 5 were given sometimes before and sometimes after the others of their respective sets. But the two-grouped and the three-grouped were always given separately. It was found more satisfactory to let the subject determine the time for hearing each rhythm; he attended to each, until he was fully satisfied, and then reported immediately.

The subjects were Mr. I. McKay, rhythmical, no musical training, considerable training in introspection; Mr. W. McKee, some training in introspection, no musical training; Miss M. F. Winger, considerable training in introspection, unmusical; Mrs. E. V. Bentley, musical, some training in introspection; Mrs. B. Brooks, some training in introspection, no musical training; Miss E. Parry, some training in introspection, no musical training; Miss C. Seymour, some training in introspection, no musical training.

The subjects made their reports in such form of metrical notation as they might find individually convenient, and not in the form that appears in the Tables. They were thus able to give their report while the rhythm was in full swing. For the sake of clearness, the reports have been tabulated in the form given, and occasional interpretatory remarks of the subjects have been added.

Results. While there was no general constancy in the accentuation of the high or low tones, *i. e.*, no constancy for *all* individuals, there was a marked constancy in the interpretation of the *same* individual throughout the different series given. Some individuals were inclined to hear the high as the more intense, others the low. The subjects may be divided

SQUIRE:

TABLE XLIII.
Two-grouped rhythm, *c* of 256, and *a* of 453 vibrations. All tones and intervals of equal duration with the exception that *a* in *disc 2* and *C* in *disc 3* are increased by a temporal increment of 1-6.

Disc no.	Objective Rhythm	1.	2.	3.	4.
Subjective.		a a a a a	a c a c a	a c a c a c	a c a c a c etc.
B. B.	No grouping.	A two-grouped rhythm; higher tone is first and longer, it appears to approach and the lower tone recede.	While higher tone is sharper, the lower appears to be stressed musically. Lower tone first in group but higher is longer.	Rhythm same as with disc 2.	Rhythm same as with disc 2.
I. M.	A two-grouped, first longer and more intense.	Low tone is first and longer; it appears to be the integral part of the foot.	Lower tone is first, is longer and more intense.	Rhythm same as with disc 2.	Rhythm same as with disc 2.
W. M.	No grouping.				
F. W.	All tones of equal duration and intensity; can group by 8s, 4s, or 3s.	Lower tone appears to be first but higher, is longer and is accented; tried to change the accent but could not.			
C. S.	All tones of same pitch, but grouped into 2s.	Higher tone is first, is longer and is more intense.			

TABLE XLIV.
Three-grouped rhythm; c of 256 vib. and a of 453 vib. All tones and intervals of equal duration with the exception that a in disc 8 and c in disc 9 are increased by a temporal increment of 1-4.

Disc no.	5.	6.	7.	8.	9.
Objective Rhythm.	a a a a a	a cc a cc a cc	c aa c aa c aa	a cc a cc a cc	c aa c aa etc.
Subjective. B. B.	No grouping.				
I. M.	A two-group; the first tone slightly longer and stronger than the second.	The higher is first and is longer. The two low are of about equal duration. The first is separated by a long interval from the second.	At first the lower tone has the first place in the group; later it has the last place. The lower tone is longer and is accented.	Rhythm same as with disc 6; the high tone has a stronger accent than in that rhythm.	The two high tones are longer and are accented; but the low tone has first place in the group.
W. M.	No grouping — but if I think of the clock, the tones are grouped in a two-rhythm and the first is accented,	The higher tone is first; it is longer and is accented.	Two distinct parts to each group. The two low tones are shorter and are separated by a long interval from the higher tone which comes last, although longer and accented.	Rhythm much same as with disc 6; but interval between 1st and 2d tone is quite long.	Much same as 7; but not so pleasant; it does not hold together as well.
F. W.	Can group by 8s or 4s.	The higher tone is first; it is longer and stronger. The two low tones are of equal duration and intensity.	The first tone is higher, and is shorter, but is accented; the second and third tones are longer than first and are higher; and at last the accent is placed upon the two higher tones.	The first tone is short and is low. The second and third are longer and appear to be of equal duration, intensity and pitch. Long intervals follow the first and third tones.	The first tone is higher, and is longer and is accented; the second and third are longer and are accented.
C. S.	A two-rhythm.	The first is longer and stronger than the second and third.	Finds no pitch difference; the first is longer and is accented.	Same rhythm as with discs 6 and 7.	

TABLE XLV.
Two-grouped rhythm: a of 453 vib. and c of 512 vib. All tones and intervals of equal duration, with the exception that c in disc 3, and a in disc 4 are increased by a temporal increment of 1-6.

Disc no.	1.	2.	3.	4.
Objective.	a. a. a. a. a.	c. a. c. a. c. a.	c. a. c. a. c. a.	c. a. c. a. c. a. etc.
Subjective. B. B.	No grouping.	First tone is longer and higher. shorter, the second longer and lower.	The second tone is higher but longer and is accented. (This subject confuses high and low.)	Same as 2 and 3.
I. M.	A two-rhythm; first tone longer and more intense.	First tone is longer, higher and accented. The second is a bagatelle at the end of first, to make up a horse's gallop.	Indistinguishable from rhythm of disc 1; whole is slower and not so clear cut.	No great difference in the length of the two tones. The first is slightly longer and more intense; it is the lower tone.
W. M.	No grouping; by effort can throw it into a two-rhythm.	First tone lower, longer, and more intense.	First tone higher, but the second longer and more intense.	The first tone is higher, but can change accent at will.
F. W.	All alike; can group by fours, eights or threes.	No temporal difference. The first tone is higher and more intense.	The first tone is lower and longer.	Same as with disc 2, accent very slight. (This subject apparently does not perceive pitch differences of a minor 3rd.)
C. S.	A two-group with first tone longer and stronger.	The second tone is more intense, and is longer. No pitch difference.	—	—
E. P.	A two-rhythm; reminds her of the ticking of a clock.	No difference in intensity, but the first is longer and higher and receives the accent.	Same as with disc 2.	—

TABLE XLVI.
Three-grouped rhythm; a of 453 vib. and c of 512 vib. All tones and intervals of equal duration with the exception that c in disc 8 and a in disc 9 are increased by a temporal increment of 1/4.

Disc no.	5.	6.	7.	8.	9.
Objective.	a a a a	c a a c a	a c c a c c	c a a c a a	a c c a c c
Subjective.	A two-group first longer and more intense.	The longest and lowest is last; it is least intense. The second is most intense.	The highest is first, it is longest. It appears to sound through the others like the air to bass accompaniment.	The first is highest, longest and strongest. The second and third have same pitch, duration and intensity.	The first is longest and most intense. The second and third are either first or last in the group. (High and low are confused.)
B. B.					
I. M.	A two-group; but no distinguishable difference in tones.	The highest is first, second and third are longest. Second and third are of equal duration. The second is longer than the third.	The lowest is first, it is longer and more intense. The second is longer.	Same as rhythm of disc 6.	Same as with disc 7.
W. M.	No grouping, even with great effort.	The highest is shortest; it may come first or last. The other two are longer and more intense and equally so.	The two 'higher' are shorter but are both accented. The lower tone comes last in the group.	Same as rhythm of disc 6.	Same as 7; Both 7 and 9 are annoying and unstable.
F. W.	All alike; but can arrange in any grouping; when subject gives up to rhythm, it falls into groups of twos.	The higher tone is first; it is more intense, but the two lower tones are longer.	The higher is first, longer interval second, and third are of equal duration.	Rhythm same as with disc 6.	Same as 7, except that the first and most intense tone is also the longest.
E. P.	A four-rhythm broken into groups of twos.	The higher is shorter and comes last; it is separated by a long interval from the second. The first and second are of apparently equal duration and intensity. (High and low are confused here.)			

TABLE XLVII.
Two-grouped rhythm: a of 453 vib. and c of 512 vib. All tones and intervals of equal duration with the exception that c in disc 3 and a in disc 4 are increased by a temporal increment of 1-3.

Disc no.	I.	2.	3.	4.
Objective.	a a a a a	c a c a c	c a c a c a	c a c a c a
I. M.	A very poor two-rhythm; sometimes none at all, at other times the first is stressed.	The first is longer. This is higher but lower than the low tone comes with a long inspiration, the low with the expiration and is more rapid, full and of greater strength.	First tone is longer and higher but lower than the low tone comes with a long inspiration, the low with the expiration and is more rapid, full and of greater strength.	The high tone is first but is shorter than the low tone which is accented. It is an odd and decided rhythm.
F. W.	No accent; can group in twos.	Higher is first; it is longer, a dragging tone. The lower is more concise; it is accented.	The higher is longer and more intense; it is first in the group.	The higher is first, but it is shorter than the lower tone; could not tell at first how this rhythm varied from that of discs 3 and 3.
E. P.	A two-group; first slightly longer.	The higher tone comes first, is longer and more intense; the second seems like an echo of the first.	Same rhythm as with disc 2, but higher tone is longer and the interval following it shorter.	The higher tone is first and is accented; it is about 3 times as long as the low tone. (Confusion of the higher with lower by this subject.)
E. V. B.	A four-grouped rhythm; first tone accented.	Lower tone comes first and is accented, although the higher is longer.	Lower tone is first and is accented, although the higher is longer. Rhythm is jerky.	The lower tone is first and is longer and more intense. (This subject shows a strong tendency towards accenting the lower tone.)
E. V. B. (On second day).	A four-grouped rhythm. Monotonous.	The lower tone is longer and stronger and is first in the group.	The lower tone is longer and stronger and seems as if sung with inspiration.	The lower tone is longer and stronger and has the first place in the group.

TABLE XLVIII.
Three-grouped rhythm; a of 453 vib. and c of 512 vib. All tones and intervals of equal duration with the exception that c in disc 8 and a in disc 9 are increased by a temporal increment of 1-2.

Disc no.	5.	6.	7.	8.	9.
Objective.	a a a a a	c a a c a a	c a a c a a	c a a c a a	a c c a c c
I. M.	A two-group. The first tone is a little louder and longer, but this difference may be destroyed by analytic attention.	The higher is longest and most intense if it is greater. The other two are of equal duration and intensity.	Same as 7.	This seems different; but can't tell in what the difference consists.	
F. W.	Most pleasant grouping is by twos, can group by fours, threes or twos.	The higher tone is first; it is louder, although more intense than the second and third. The second and third tone is longer than the third.	The higher tone is longer and more intense than the two lower tones. (Confusion of high and low.)	The higher tone is first; it is longer and more intense than the two lower tones. The shortness of the interval after the first makes the disc seem in a hurry.	Same as 7. (Confuses high and low.)
E. P.	Same tones; group of eight broken into fours. Primary accent on second tone, secondary on fourth.	All tones are of same duration but the higher is more intense.	All tones are of the same intensity and duration; the first tone is the highest, and third are of same pitch and intensity. (Begin confusion of high and low.)	All tones are of the same intensity and duration; the first tone is the highest, and second and third are of same pitch and lower than first.	Same as 7. (Confuses high and low.)
E. V. B.	A four-grouped rhythm; first group accented; unpleasant by contrast with other rhythms.	Two lower tones are longer and more intense than the higher; the first is longer and more intense than the second. Hightone is last.	The low tone is longer, stronger than the two higher, which are of equal duration and intensity. This rhythm is pleasanter than 6.	Rhythm same as with disc 6. High, although objectively longer, is heard as shorter.	Same as rhythm of disc 6. High, although the duration of the accented and unaccented is much greater than in that case.
E. V. B. On second hearing.	Something like 1, but higher, quicker and brighter.	Report same as on previous day.	Report same as on previous day.	Rhythm same as with disc 6. High, although the duration of the accented and unaccented is much greater than in that case.	

into three classes,—those who accented the high tones, those who accented the low, and those to whom highness and lowness, as such, were a matter of indifference. With these subjects, in the three-group the accent fell upon the tone which was different from the other two in the group: $c^1 a a$ or $a^1 c c$; *i. e.*, either c or a might be accented. The constancy with which the low tone was accented in the case of *E. V. B.* was very marked. With Disc 6, where the objective arrangement gave two low tones and one high, had there been no constancy in her interpretation of difference in pitch, the high tones as different from the other two would have been accented. On the contrary, she accented and lengthened the *first low* in both series given. In the case of Disc 8, the results show in a most striking manner a natural tendency to accent the low tone; here c is objectively lengthened, being one-half again as long as either a ; it also, as in the arrangement of Disc 6, occurs but once in every three tones. It would seem in this case that the objective conditions must of necessity determine the rhythm. But, on the contrary, the *first a* is heard as *longer* and stronger. In Disc 3 the high tone is objectively longer. *E. V. B.* still gives the accent to the low tone, although the high is judged longer. For this subject, pitch is not only a constant determinant but also a more effective determinant than time, as judgments upon Discs 3 and 8 show. *E. V. B.* had had a considerable musical training; in fact she was the only 'musical' subject.

W. M. showed the same tendency. Where the interval was only a minor third, the low tone was invariably subjectively lengthened, and with but one partial exception accented. Even in the case of Discs 6 and 8, the subjective rhythm was the same as for *E. V. B.* With Disc 3, although the objective lengthening of the high tone resulted in giving it the first place in the group, the low tone was judged longer and more intense. But with the larger interval, the subjective rhythm for Disc 6 corresponds with the objective order; although the high tone was subjectively accented, it was (curiously) judged as lower. With Disc 8 not only the high but also the first low was accented.

E. P., although she almost invariably judged high low and low high, was strongly inclined to accent the objectively low, even though the judgment resulted in a seemingly distorted rhythm.

Other subjects were fully as determined to accent the high. *F. W.* was typical of this class. In her preliminary intensity judgments it was necessary to make the high tone considerably weaker than the low (on the basis of the judgments of the other subjects) in order to get a judgment of equality. As a

rule, the high tone came first in the group. Disc 9, when arranged in accordance with the objective order, was said to be unpleasant; this was undoubtedly due to the compulsion which the objective lengthening of a low tone (and the arrangement one low to two high) exerted upon F. W.'s natural grouping. Here, as with *W. M.*, high and low were confused. When F. W. accented the low tone, she called it the high. The tendency of C. S. was in the same direction. One great difficulty in interpreting the results for the two-group was the determination whether subjectively high and low corresponded to objectively high and low; in the three-group the arrangement of the three tones gave a basis for determination. When confusion of judgment was found in the three-group, the presumption was that it was present also in the two-group.

B. B. and *I. M.* were examples of the third type. Pitch was for them not a constant determinant of rhythm. The subjective order was determined by change of any sort; in a three-grouping consisting of two high and one low, the low was accented; but if the arrangement gave two low and one high, the high was accented. "Awareness of change" seems for these subjects to be the determinant of rhythm.

In the light of these equivocal results, how are we to interpret the great constancy with which the accented tone in a motor rhythm was raised in pitch? It will be remembered that cases of inversion in pitch were more frequent than in time or intensity; but even then the percentage was very low. What does increase in pitch mean for the producing subject? *An increase of intensity is quite probable, because of the necessary increase in the force of a blast of air to produce a heightening of pitch.*¹ This is in perfect accord with the results of the experiments on the motor rhythm, in which intensive and pitch differences were nearly always correlated. Pitch, then, is a constituent and constant factor in the spoken rhythm, but not necessarily as a qualitative determinant. Because of physical and physiological conditions it is an accompaniment of any intensive change. It is only an intensification of the intensive factor. In the sensory rhythm, the criteria of the spoken rhythm (strain sensations and tension in the trachea and vocal organs) were absent, unless there had been strong associations set up. Neither was there a physical or physiological reason for the constant appearance of variation in pitch. Pitch in the sensory rhythm owes its direction and constancy, when they are present, to the character and force of the individual associations. Where, as with *E. V. B.*, musical training has given strength

¹Text book of Physiology, edited by E. A. Schäfer, 1900, Vol. II, p. 127.

and constancy to the association, we find that pitch has great effectiveness as a determinant of rhythm; but with subjects who have few associations of an unequivocal character, pitch as such can scarcely be said to determine the rhythm. It is not necessary that the association be of a musical character for it to have considerable constancy. The associations were very frequently of a spatial character; high was "nearer," low was "farther away;" low was "big," and high was "thin." One subject spoke of the high tone as "a silly little appendage." Still another subject was governed largely by spatial associations of another character; he placed the high tone in the top of the head, the other at the base of the skull, and experienced a 'flipping' from the one position to the other as the tone changed.

We can, then, say that quality is not an independent determinant of rhythm; it can be considered either as a substitute for or as an intensification of intensity,—whether because of strain sensations common to both, or because of associations which, reduced to their ultimate grounds, are of an intensive character.

In the arrangement of the tones as to pitch, owing to objective conditions (only two forks being used), the order was necessarily either high-low or low-high. Both of these occur with nearly the same frequency. In the motor rhythm, the orders for the three-group were  or  or , of which the third was the most pleasing; probably for the same reason that intensities arranged in a corresponding manner  give a more pleasing impression. Such a group has a more unitary character. It would be interesting to obtain the judgments of adults as to the more or less satisfactory character of these different arrangements; but the necessary time was wanting.

The subjects, when questioned as to the course of the attention and its effect upon the rhythm, were unanimous in declaring that they attended to a group as a whole; it was the unit of attention. This tendency was so strong that it was frequently difficult for subjects to analyze what they had heard, although they 'felt' differences between the various rhythms. With E. V. B. it was always necessary to reproduce the rhythm by humming it before she could make an analysis.

Some of the remarks of the different subjects with regard to attention are given below. B. B. "The sounds were all loud at first, then became less distinct for a brief space, after which they were stronger again." "I tried to keep the sounds from growing fainter by concentrating the attention upon them, but succeeded only in prolonging the stronger." I. M. "The unit of attention was the foot; the character of the foot was determined by the accent of the syllable which

was the center of attention." "An attempt to inhibit the muscular movements makes the whole rhythm appear more uniform. The withdrawal of the attention seems to obscure the rhythm and cast it out of consciousness. I do not think the rhythm would disappear if I could attend to the tones and at the same time inhibit my movements." E. P. "The natural course of attention is from group to group." W. M. says of Disc 9: "When attention wavers the pattern can be changed, the different forms come and go rapidly." E. P. "Attention was upon the melody in general, but occasionally when analysis was somewhat difficult or combination unpleasant the attention wandered off to the separate tones, their duration, quality, etc."

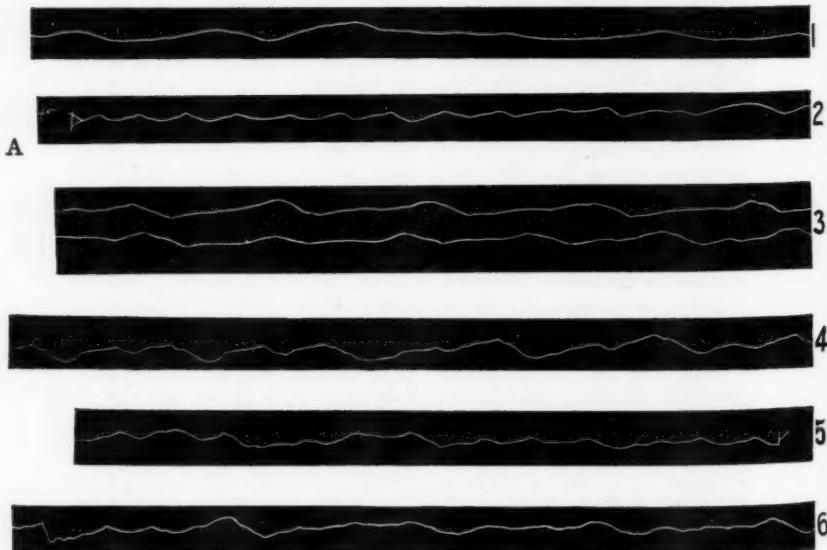
Accent. The subjects were not questioned as to the nature of their subjective accent; but finding interesting data on that point in their reports, data bearing upon the whole question of perception of rhythm, we collated them and give them with the name of the subject.

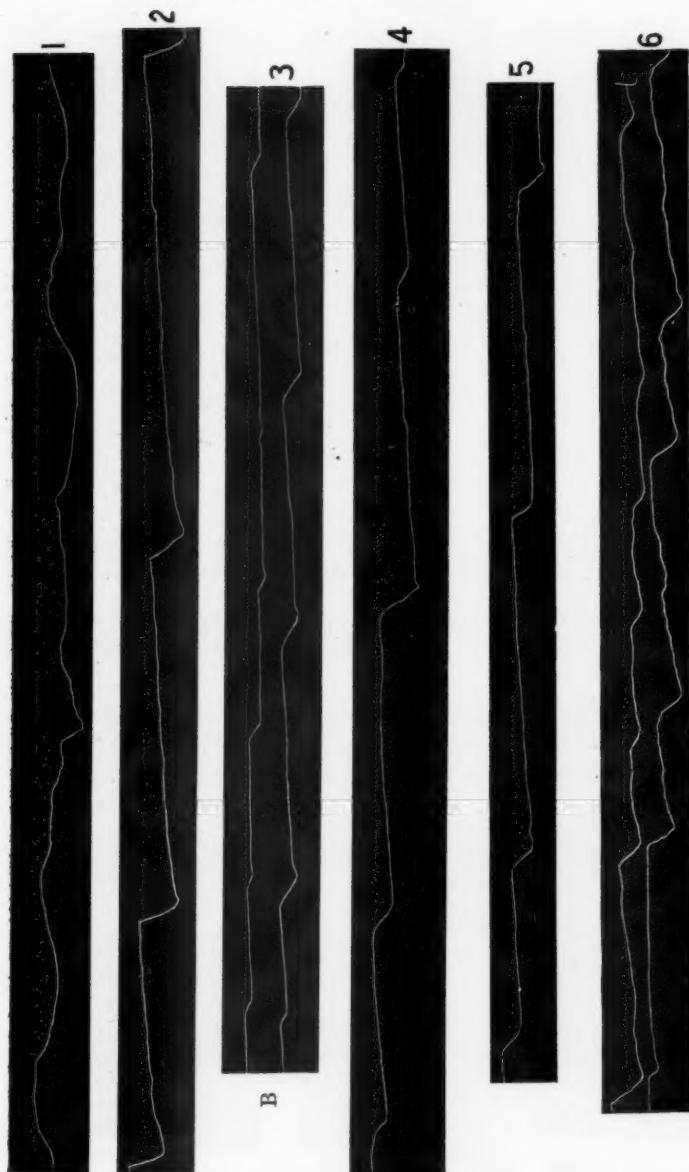
I. M. says with regard to Discs 5 and 6: "It is impossible to tell where the stress is in the feet. When I pay attention to intensity, pitch and duration they appear to be equal in each; so that the stress does not appear to lie in any one of them. There are of course the muscular sensations, but it is difficult to believe that there is not an objective rhythm." F. W. says of Disc 3: "The two tones take the accent equally well. The high one because it naturally comes first and seems to give the push or impulse to the whole thing. The second note could take it because it seems to be stronger and has a longer interval after it; I can change the accent at will." I. M. says with regard to Disc 1: "When I succeed in obtaining a rhythm, the first is more stressed and a little longer than the second, in which case there also appears to be some difference of quality but not of pitch." He says of Disc 3: "The high tone appears to be given with an inspiration, which is long, the low with an expiration, which is rapid, full, and stronger." E. P. says of Disc 2: "The higher is accented, but both are of approximately equal intensity." And with regard to Disc 6: "The three tones are of equal intensity but the accent falls on the two low tones." F. W. says of Disc 4: "Not easy to accent, but a little easier to accent the long. I can put it on the high and short, but do not like it so well. Moving the fingers helps placing of accent." With regard to Disc 1: "I cannot accent it. Tried to place it but it fell on all." On the same day, she says of Disc 2: "Main accent is on the long, but short and high is slightly accented too." With regard to Disc 6: "Perhaps the strongest accent is on short and high. Can put it on the first long but not on the second long." B. B. says of Disc 4: "The low tone is longer and usually more intense; sometimes the high seemed more intense; could change the accent by attention."

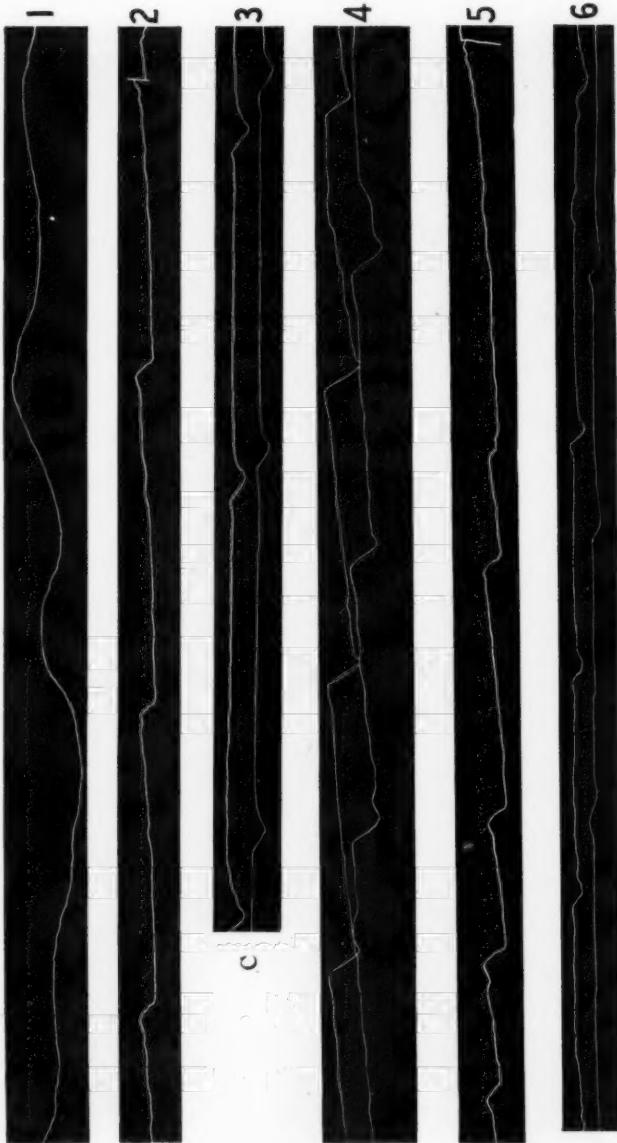
The cases of divided accent are interesting as showing that the unity of the total impression is dependent upon the objective correspondence of the most intense and longest, or at least that they stand in such a relation that they offer no objective hindrance to such a subjective interpretation. The reports of the several subjects show that accent is not dependent alone upon the objective relations of duration, intensity and quality; accent is subjective and changes with the attention. This seems to be the explanation of the facts of substitution. An objective condition which arrests the attention, be it either

through a lengthening of the tone or through increased intensity or a qualitative change or what not, is subjectively stressed or accented, in that it is thereby brought into the focus of attention. The effect of this accent of attention can be increased (a) by organic rhythms, sensations vibrating in unison with the attention rhythm; (b) by a rhythm in the affective tone. One subject, when asked to inhibit the concomitant movements, reported four distinct elements in the subjective rhythm; (1) gross up and down motions of the body; (2) resistance rhythm, due to attempt to inhibit movements; harder to resist movement in case of high tones; (3) rhythm of attention; (4) affective rhythm, indifferent-tranquil (low tone) and unpleasant-irritating (high tone). Ruling out the second factor, which arose from the special conditions, we have here two rhythms running parallel with the attention rhythm. The subject might also have added another, *i. e.*, the organic rhythm. To be sure, all these factors may not be present, although in the most perfect rhythm they are all found, fused to a total rhythmical perception.

CHAPTER III. MINOR PROBLEMS.







The three plates show respiration curves. Plate A gives a series from R. A.; Plate B a series from H.; and Plate C a series from C.D. The numbers 1-6 are used, in each series, to designate (1) the curve of normal respiration; (2) the curve taken at the time of involuntary grouping; (3) the curve taken at the time of trochaic grouping; (4) that with iambic; (5) that with dactylic; and (6) that with anapestic grouping. All curves are somewhat marred by scratches made at the time of measurement. They are reduced one-half.

§ 1. *Respiration.* The breathing was registered synchronously with the rhythm. Although the results have been frequently referred to, in the discussion of rhythm, they have not been given in detail. The character of the breathing varied with the rhythm given. The average of several curves for normal respiration of the three subjects, taken at various times during the course of the experiment, is also given for the purpose of comparison with the rhythmic respiration.

R. A.—In her rhythm each syllable had distinctness and individuality, *i. e.*, the syllable was the unit and not the group; this is apparent in her breathing.

TABLE XLIX (a), (b).

The averages for breathing during involuntary grouping.			Averages for breathing during trochaic grouping.						
Expiration.	Inpiration.	Height.	Expiration.	Inpiration.	Height.	a	b	a	b
.52 sec.	.32 sec.	3.12 mm.	.75 sec.	.649 sec.	.23 sec.	.285		3.7 mm.	3.1
.498 "	.278 "	2.98 "			.907 "	.233 sec.		2.2 mm.	
		" "			1.071 "	.366 "		4.5 "	
.475 "	.372 "	4.32 "			1.25 "	.52 "		4.13 "	
.384 "	.348 "	4.13 "			.709 "	.238 "		3.	
.448 "	.294 "	2.95 "							
Av. .465 "	.322 sec.	3.5 mm.	Av.	.984* "	.373 sec.			3.45 mm.	

Series (3) given in full, p. 506, above.

TABLE XLIX (c).
Averages for breathing during iambic breathing.

Expiration.		Inspiration.		Height.	
a	b	a	b	a	b
.571 sec.	.552 sec.	.335 sec.	.335 sec.	2.62	1.98 mm.
.597 "	.603 "	.37 "	.515 "	3.5 "	4.5 "
.49 "	.464 "	.3 "	.323 "	3.12 "	3.2 "
	.61*		.315*		2.63*
Aver. .533 sec.	.506 sec.	.335 sec.	.391 sec.	3.06 mm.	3.24 m m.

*There are two syllables to an expiration.

In the involuntary grouping (with the exception of series 3, which was given in full, as *R. A.*), there fell into a trochaic grouping) the average expiration lasted about .5 sec. and the inspiration .3 sec. The mean height was 3.5 mm.; each syllable corresponded to an expiration and each pause to an inspiration. With the trochaic grouping, an expiration lasted during the time occupied by two syllables and the intervening pause, giving an average duration of .984 sec. for the expiration; the inspiration, corresponding to the pause at the end of the group,

TABLE XLIX (d).
Averages for breathing during dactylic grouping.

	Expiration.			Inspiration.			Height.		
	a	b	c	a	b	c	a	b	c
.63 sec.	.528 sec.	.559 sec.	.256 sec.	.383 sec.	.328 sec.	.31 sec.	.3.1 min.	.3.6 min.	.3.9 min.
.554 " "	.503 " "	.548 " "	.3 " "	.273 " "	.352 " "	.2.71 " "	.2.2 " "	.2.5 " "	.2.5 " "
.554 " "	.407 " "	.473 " "	.258 " "	.317 " "	.453 " "	.2.34 " "	.2.39 " "	.3.5 " "	.3.5 " "
.49 " "	.463 " "	.584 " "	.321 " "	.387 " "	.253 " "	.3.62 " "	.3.06 " "	.3.47 " "	.3.47 " "
.515 " "	.406 " "	.497 " "	.276 " "	.281 " "	.306 " "	.3.37 " "	.3.25 " "	.4.18 " "	.4.18 " "
Aver. .548 " "	.481 " "	.532 " "	.282 " "	.288 " "	.342 " "	.3.03 " "	.3.1 " "	.3.5 " "	.3.5 " "

TABLE XLIX (e).
Averages for breathing during anapaestic grouping.

(Breathing for several series was the same as for involuntary grouping. Others are given.)

	Expiration.			Inspiration.			Height.		
	a	b	c	a	b	c	a	b	c
.646 sec.	.64 sec.	.72 sec.	.33 sec.	.37 sec.	.49 sec.	.2.8 min.	.2.7 min.	.4.7 min.	
.532 " "	.628 " "	.643 " "	.228 " "	.246 " "	.609 " "				
Aver. .589 " "	.634 " "	.681 " "	.279 " "	.308 " "	.549 " "				

had a mean duration of .373 sec. The average height did not vary perceptibly from that given for involuntary grouping. We have in the case of the trochee the only instance, with the exception of one iambic reading, in which one expiration had a duration equal to that of a group in the spoken rhythm. It is also noteworthy that the trochaic was the only grouping in which *R. A.* succeeded in giving a completely unitary character to the group. Here we have an illustration of the effect of the rhythmic perception upon the breathing; *i. e.*, with the

trochee, the most natural form of rhythm, the group was perceived as an unit, and the breathing took on the same character; with the iambus, dactyl and anapæst, the breathing curve is of a peculiar character. Here, although an expiration corresponded to each syllable and an inspiration to each pause, wherever there is a subordination of syllables to the group it is shown in the respiration curve; for example, in the dactyl each group of the respiration curve is divided into three smaller parts, in which the longest expiration corresponds with the first syllable, the shortest expiration and least excursion with the second syllable, and the medium long and high with the third. A complete failure to produce the rhythm was shown quite as clearly on the breathing curve as on the rhythmic, by a primary type of breathing. The respiration curves for the iambus, dactyl and anapæst bear evidence in the case of *R. A.* to an imperfect perception of rhythm; while the relation of the syllables to each other was perceived, the whole was not an object of immediate time perception as with the trochee. We have rather a series of perceptions which are compared with one another.

TABLE L (a).—*H.*
Averages for breathing during involuntary grouping.

	Expiration.	Inpiration.	Height.
	6.13 sec.*	.3 sec.	16. mm‡
	3.9 " *	.3 "	9.7 "
	4.6 " *	.268 "	?
	4.55 "	.319 "	4.68 " §
	2.66 "	.291 "	9. "
	4.268 "	.3 "	8.66 "
	3.918 "	.288 "	6.75 "
Average,	4.289 sec.	.295 sec.	7.46 mm.

*Another subject.

†The excursion of the tambour was changed after this series.

‡The first record for *H.*

TABLE L (b).
Averages for breathing during trochaic grouping.

	Expiration.	Inpiration.	Height.
	4.2 sec.	.266 sec.	6.33 mm.
	3.506 "	.293 "	4.1 "
	4.86 "	.308 "	6 "
	4.436 "	.325 "	4 "
Average,	4.35 sec.	.298 sec.	5.8 mm.

TABLE L (c).
Averages for breathing during dactylic grouping.

	Expiration.	Inhalation.	Height.
	5.175 sec. 4.62 "	.15 sec. .286 "	6.833 mm. 7.83 "
Average,	4.897 sec.	.208 sec.	7.331 mm.

TABLE L (d).
Averages for breathing during iambic grouping.

	Expiration.	Inhalation.	Height.
	3.9 sec. 4.61 " 4.75 " 4.05 " 4.63 " 4.05 "	.25 sec. .283 " .3 " .306 " .319 " .34 "	3.8 mm. 3. " 4. " 3.25 " 3. " 8.7 "
Average,	4.28 sec.	.299 sec.	4.425 mm.

TABLE L (e).
Averages for breathing during anapæstic grouping.

	Expiration.	Inhalation.	Height.
	6.195 sec. 4.683 " 3.6 " 4.06 "	.287 sec. .325 " .31 " .356 "	7.75 mm. 7.83 " 3.2 " 3.25 "
Average,	4.633 sec.	.319 sec.	5.51 mm.

TABLE LI (a).—C. D.
Averages for breathing during involuntary grouping.

	Expiration.	Inhalation.	Height.
	5.5 sec. 5.95 " 6.108 " 5.958 " 6.38 " 5.878 " 4.58 "	.625 sec. .45 " .325 " .241 " .333 " .561 " .231 "	8.25 mm. 10.55 " 12.8 " 10.6 " 8.5 " 11. " 11.25 "
Average,	5.765 sec.	.395 sec.	10.41 "

TABLE LI (b).
Averages for breathing during trochaic grouping.

	Expiration.	Inpiration.	Height.
	1.336 sec.	.292 sec.	12.4 mm.
	1.524 "	.328 "	3.8 "
	2.247 "	.278 "	3.2 "
	1.98 "	.209 "	2.8 "
Average,	1.771 sec.	.276 sec.	(5.39)mm 2.76 mm

TABLE LI (c).
Averages for breathing during iambic grouping.

	Expiration.	Inpiration.	Height
	5.8 sec.	.4 sec.	4.75 mm.
	4.05 "	.275 "	3.75 "
	7.5 "	.366 "	3.8 "
	4.95 "	.375 "	4.5 "
Average,	5.57 sec.	.354 sec.	4.2 mm.

TABLE LI (d).
Averages for breathing during dactylic grouping.

	Expiration.	Inpiration.	Height.
	4.45 sec.	.25 sec.	6.5 mm.
	4.89 "	.342 "	5. "
	4.99 "	.312 "	4.5 "
	4.27 "	.318 "	6.33 "
Average,	4.65 sec.	.305 sec.	5.58 mm.

TABLE LI (e).
Averages for breathing during anapaestic grouping.

	Expiration.	Inpiration.	Height.
	2.305 sec.	.308 sec.	4.05 mm.
	3.36 "	.3 "	5.6 "
	2.11 "	.27 "	2.9 "
	2.704 "	.229 "	2.5 "
Average,	2.622 sec.	.276 sec.	3.53 mm.

TABLE LII.
Averages for several series of normal breathings.

	Expiration.	Inpiration.	Height.
C. D.	2.175 sec.	1.51 sec.	7.65 mm.
H.	2.165 "	1.975 "	14.25 "
K. A.	.96 "	.72 "	2.89 "

With *H.* and *C. D.*, the perfect correlation between the rhythms of speech and of respiration seen in *R. A.*'s reading was not found. One expiration included from six to ten syllables; thus one breathing curve covered several groups. The only difference between respiration during the free readings and the trochaic, iambic, dactylic or anapaestic readings was the greater height of the curve during the free reading.

Comparing these curves with the normal, we find in the case of *R. A.* that the respiration time, both for expiration and inspiration, is shortened, and the height increased. (The trochaic grouping is an exception, but here her breathing curve approximated that of *C. D.* and *H.*) *R. A.*'s normal breathing was very superficial, and became somewhat deeper in speaking. With *H.* and *C. D.*, on the contrary, the expiration time during reading of the rhythms is considerably longer than the normal, while inspiration is markedly shorter, and height is very noticeably decreased. The change in *R. A.*'s breathing is an example of the general rule that exercise increases the depth and frequency of respiration. The reason that her rhythmic respiration curve is thus typical of the respiration curve for exercise is probably to be accounted for by the fact that the perception of the rhythm as such had slight influence upon the respiration, *i. e.*, the purely physiological factors present in increased activity were the important elements. But with *C. D.* and *H.* this general principle is completely neglected. We must look for some other factor which has reversed the results. This factor we can reasonably presume to be an important element in the perception of the rhythm, since it occurs only in the case of *H.* and *C. D.*, with whom the perception of rhythm is much more perfect than it is with *R. A.* It is undoubtedly a psychological factor, since there has been no change in the physiological condition that would bring about such a startling reversal of the general rule. The curve appears in the main to agree with that given by Lehmann¹ for strongly concentrated attention. In general, then, the lengthened expiration and decreased height of the curve would seem to indicate an attentive state in which the attention was directed forward. The great regu-

¹ Die körperlichen Äusserungen psych. Zustände, 1899, pp. 68 ff.

larity of the curve, and the subnormal height, point to the absence of any affective element. Lehmann, in his discussion of expectant attention, or in other words an attention which is directed forward ('expectant' has been used so frequently to connate a conscious state with a strongly affective tone that it seems well to avoid the term in this case) says: "Zu den Af-fekten oder Stimmungen kann man diesen Zustand nicht rechnen, weil er im Allgemeinen nicht gefühlsbetont sein wird." Bolton's Subject D. was inclined to refer all his time judgments to what he considered his natural rate of breathing; but rate of breathing, as experiments have shown, is not a constant factor in terms of which a judgment could be made; it is much more likely to take on the tempo of the rhythm than *vice versa*.

One might perhaps seek to explain the peculiarities of a respiration curve by the necessary changes accompanying regular speech; but we should hardly in that case find such pronounced individual differences in the curves. Moreover, it has been found by others that the hearing of rhythm affects the breathing. One subject, in the series taken with adults, said upon hearing Disc 5 immediately after the two-group that she found her breath coming faster as she listened to it.

No record was taken of the changes in the pulse, but it is probable that the change in the pulse follows from the change in breathing, and is therefore of secondary importance. Bolton's Subject 4 reported that the click which came nearest to the heart-beat seemed always to correspond with it, and that those coming between formed a group.

§ 2. CONCOMITANT MOVEMENTS.

There are other movements which, under certain conditions, frequently accompany the hearing or production of a rhythm; but these have neither the constancy nor the universality of the respiration and pulse rhythms; yet, as their presence or absence together with other characteristics of rhythmical grouping bears on the general question of the nature of rhythmical perception, they have been noted, together with the conditions under which they arose. Movements of this sort were scarcely ever present in the experiment with the microphone, while they were very frequently present in the freer readings of Method I. They were also remarked by nearly all of the adult subjects upon certain occasions. Many of the movements were apparently closely connected with the breathing.

In the reading of the German children the accented syllable was often spoken with a strong expiration which threw the head forward. Nearly all of the concomitant movements of the German children were of this sort. As they were closely con-

nected with the breathing, they could not be classed in the same category with those movements which are not necessitated by speech, but are clearly the response of the body to the rhythm. For example, tapping with the hand or foot.

TABLE LIII (a).
Concomitant Movements of the German Children.

	Expiratory.	Pendular.	Upward.
Trochee.	27	6	7
Iambus.	28	3	3
Dactyl.	20	6	7
Anapæst.	26	6	4

Although the movements in far the greater number of cases were merely expiratory, there were frequent occurrences of a pendular movement; also a raising of the body, which was always found together with a rising pitch. In this connection it is to be noted that Subject I. M. found the tendency to movement stronger upon hearing the high tones than the low. F. W. also said that there was an involuntary twitching of the eyelids upon hearing the high notes.

The movements of the American children were greater in variety, freer, and less obviously the result of changes in respiration.

TABLE LIII. (b).
Concomitant Movements of the American Children.

	Expiratory.	Pendular.	Upward.	Nodding of head.	Foot and hand.
Trochee.	8	20	13	43	8
Iambus.	10	13	22	31	8
Dactyl.	5	13	13	48	9
Anapæst.	4	2	23	25	6

Absence of movement was generally correlated with imperfect grouping; only two apparent exceptions were noted in the total number of readings for all classes and grades.

Adults, when pendular movements were present, frequently spoke of an association with the clock. Bolton notes the same fact.

What is the character of these concomitant movements? All, except those directly resulting from respiration, are unnecessary to the motor rhythm, and more emphatically so to the sensory. A few, such as the pendular, seem to be due to associations with external objects or with movements of the body. One fourth grade boy, when told what he was to do, was reminded of the movement of beating time. Subject W. M. found that he accompanied the auditory rhythm with movements of

the muscles of the throat, and that during the course of the hour the throat tired noticeably.

There are other concomitant movements which are not so readily subsumed under the principle of association. They seem rather to be of the nature of diffusive movements due to excessive excitation. Lehmann¹ explains them thus:

"Es liegt nun einmal in der Beschaffenheit der Nervensubstanz selbst, dass jede hinlaenglich starke Reizung eines Sinnesnerven eine Bewegung hervorruft, die sich nach dem ubrigen Teilen des Nervensystems fortpflanzt. Diese Fortpflanzung, Irradiation, kann im entwickelten Bewusstsein durch willkuerliche Hinrichtung der Aufmerksamkeit gewöhnlich in bestimmter Richtung geleitet werden; ist der Reiz aber zu stark, oder tritt er so plötzlich ein, dass die Aufmerksamkeit nicht sogleich die richtige Richtung einschlagen kann, so wird die Irradiation wahrscheinlich nach allen Seiten vorgehen. Trifft die Bewegung dann die motorischen Zentren, so ruft sie eine vermehrte Innervation mithin eine Kontraktion der mit dem betreffenden Zentrum verbundenen Muskulatur hervor." Are these movements, both the associative and the diffused, of the nature of expressive movements, or are they to be regarded as means by which a difficult activity is reinforced? The facts observed would bear out either of these presumptions. One first grade boy failed on the complex forms, returning every time to a primary rhythm. We asked him to accompany the spoken rhythm with a clapping of the hands, and he succeeded in producing a dactylic rhythm with marked time and intensity differentiations, but 12 sec. slower than the reading he had previously given. F. W. moved her fingers to the rhythm, in order to place the accent when she was not sure of it. W. M. says: "When attention began to flag there was a tendency to keep the time by bobbing the head." I. M., very rhythmical and prone to accompany all sensory rhythms with some bodily movement, when asked to inhibit them and notice the effect on the rhythm, found that the rhythm was much obscured; but he was not sure whether the obscuration arose indirectly, through the focusing of the attention upon the inhibition of the movements instead of upon the rhythm, or directly, as a consequence of their inhibition. On another day he reported: "I observed a sidewise movement of the head. I think it was by this equal pendular movement that I judged the duration. I also observed that by stopping the movement the rhythm disappears more than on any other occasion." (With the Disc employed the tones were all of equal duration, intensity and

¹ Die Hauptgesetze des menschlichen Gefühlslebens, Leipzig, 1892, p. 292.

pitch; thus the rhythm was entirely subjective.) Bolton's subjects found difficulty in maintaining the grouping if they restrained these movements.

On the other hand, the children do not appear voluntarily to accompany the spoken rhythm with movements of this nature until they have acquired considerable facility in producing the rhythm.

Miss Smith¹ makes an interesting inference with regard to the concomitant movements. She believes that the reason we have come, in our civilized state, to pay less attention to the rhythm and more to the content in operatic music is that we sit and listen, and do not move with the rhythm. She thus makes movement the primary factor in rhythmical perception. Meyer² also believes that rhythm can be directly sensed only through bodily movement. Meumann (p. 261) regards the relative importance of the different modalities for rhythmical perception as determined by their relation to time estimation. The closer their connection to time estimation, the greater is their importance for rhythmical perception. The most important in that case are the auditory sensations, since they are almost exclusively the source of time estimation. The movements, then, are much less important for the perception of rhythm, since they also serve us in estimating spatial relations; and least of all in importance are the visual sensations, since they have little connection with time estimation. But the weight of evidence from the facts of introspection and observation does not bear Meumann out in this respect. Subjects have been found, who, while unrhythmical, were able to estimate time most accurately. Cf. Miss Smith.³

Several primary teachers were questioned as to how the children learned new songs. The answers were unanimous that the children first learned the tempo by the beating of time with hands or feet. Wundt⁴ says: "Von unserer Bewegung her, in der wir das Rhythmische am frühesten finden, nennen wir daher den Rhythmus überhaupt eine nach genau bestimmtem Mass fortschreitende Bewegung. Aber in der Feinheit, mit der es die Schritte der rhythmischen Bewegung auffasst, übertrifft dann unser Ohr weit die ursprünglichen Bewegungsempfindungen." Buecher,⁵ after his exhaustive study of primitive music, concluded: "Ohne rhythmische Körperbewegung kommt der Gesang bei diesen Völkern überhaupt nicht vor." In the primitive dances, as well as those of children, where the

¹ *Op. cit.*, p. 297.

² *Beiträge zur deutschen Metrik*, '97.

³ *Op. cit.*, p. 289.

⁴ *Grundzüge*, II, p. 91.

⁵ *Op. cit.*, p. 44.

rhythm of the dance, the clapping of hands, are combined with rhythmic sounds from an instrument, the acoustic rhythm can be regarded as secondary to the rhythmical bodily movements.

There is also an apparent priority in the development of the different rhythmical movements. The clapping of hands and stamping of feet are earlier than rhythmical speech. None of the American boys of the first grade could succeed in producing a rhythm more complex than the trochee. Some of them failed even in that. Four out of five of these boys were present on the day that we tested them on ability to clap the same rhythms, and also the power to keep a given tempo in marching.

R. cannot keep time in marching, although he claps all the rhythms successfully.

E., colored, marches in perfect time; has no difficulty in clapping any of the rhythmical forms.

S. succeeds for a while in keeping step, then misses it; succeeds with trochaic and iambic, but fails completely with dactylic and anaesthetic forms.

H. marches in perfect time, and gives all the forms without the least hesitancy. This is in striking contrast with his inability to group the syllables in the same rhythmical order.

Hancock,¹ in a study of motor ability, tested one hundred and sixty children from five to seven years of age on ability to beat time. They were all successful with double time; treble and quadruple were more difficult; but all save fifteen were successful in beating these. As not more than two minutes were taken for each test, it seems reasonable to suppose that with ten or fifteen minutes of careful training all could succeed. Buecher² says: "Der Bewegungsrhythmus ist also die Ursache des rhythmischen Verlaufs der Sprachlaute, und wir dürfen vorläufig annehmen dass Letzterer ohne Ersteren möglich ist." Later, Buecher acknowledges that the gap between rhythmical movements and rhythmical speech is too wide to make it probable that the latter was derived solely and directly from the former. He therefore presumes that rhythmic speech arose partly as an imitation of the regularly recurring noises made by industrial implements (p. 308). It is difficult, however, to see wherein a causal connection between the two can be made out. On the contrary, it seems more probable that the larger rhythmical movements precede rhythmical speech, only because in the one case the co-ordinations are grosser, in the other finer and more complicated. The rhythmical nature of both resides in the regularity with which all bodily movements tend to follow one another in a healthy organism.

¹ A Preliminary Study of Motor Ability, *Ped. Sem.*, III, p. 18.

² *Op. cit.*, p. 55.

The presence of rhythmical movement does not, as Meumann has pointed out, warrant the presumption that the rhythm as such is perceived; while motor rhythm is physiologically conditioned, its perception would involve other and conscious elements.

Ewald finds an anatomical basis for the close connection of auditory and muscular rhythm in the two functions of the labyrinth; hearing, and the keeping of the muscles of the body in tone.¹

§ 3. THE RHYTHMICAL AND UNRHYTHMICAL SUBJECTS.

It is common to separate all persons into two classes, the rhythmical and the unrhythmical. Such a clear cut division is not warranted by the experimental facts. Numerous degrees in the perfection of the motor rhythm have been shown, as well as indications that there are the same gradations in the perception of rhythm; from that of a young child, who does not perceive rhythm except as a series of movements and these loosely connected, to the older children, whose perceptions were very complex, involving not only numerous bodily rhythms, but auditory and affective rhythms as well, all fusing to a total perception; an unitary impression arising from the manifold of sensation.

The Unrhythmical Subject. Perception of rhythm may fail because of a physiological defect, auditory or motor, or due to imperfect connection of the auditory and motor centers; or it may be psychologically conditioned. An inability to control the attention, or to compare sound with sound or movement with movement, might cause failure in perception of rhythm. Still, this does not seem to exhaust the possibilities by which failure to perceive rhythm may arise. Two boys of the upper grade, one German, the other American, were decidedly unrhythmical. By this we do not mean that they were totally unable to perceive rhythm, but that the forms which they produced lacked the unitary character and the completeness of those produced by others. Yet they were characterized by their respective teachers with the phrases "denkgründlich" and "reasons everything out." Clearly in this case perception of rhythm was not a function of general intelligence. When, however, we consider the direction of attention which has been found necessary, in order that the subjective rhythm may arise, it becomes possible to explain these cases. In the subjective grouping, there is always a surrender of the attention to the series of sounds not as separate but as successive. With these

¹ Ewald: *Untersuchungen über das Endorgan der Nervus octavus*: Wiesbaden, '92. Quoted by Meumann, p. 261.

boys, it is probable that the attention was not directed upon the succession of sensations but upon the reason for the experiment. Such a critical, analytical state of mind was destructive of the rhythm.

At the present time we are testing a student who shows certain abnormalities in the perception of sensory and motor rhythm. The experiments are not completed. They are (1) a test of the subject's perception of the series of auditory rhythms (the same as given to the normal subjects), upon which he reports; (2) a test of ability to tap certain required forms, the intensity and duration of which are registered by means of a transmitting tambour upon the kymograph drum; (3) a combination of the first and second tests. The subject reacts to the auditory sensations as they are given. The reaction in this case is registered upon the drum for comparison with the objective rhythm given by the disc.

§ 4. HOW DOES PERCEPTION OF RHYTHM DIFFER FROM ANY OTHER PERCEPTION OF SUCCESSIVE STIMULI?

1. It appears to be a phenomenon characteristic of but two modalities, audition and movement. 2. The sensations must follow one another regularly and within certain time limits, the upper of which, .1 sec., is the average rhythm of the cortical cells.¹ The lower time limit for perception of rhythmic succession, 1 sec., is near the lower limit of the organic rhythms; and the most favorable rate, between .3 and .6 sec., corresponds to the natural rate of certain bodily rhythms.² These organic rhythms cannot be regarded as sources of the perception of rhythm; they do, however, make a fusion of the attention and organic rhythm, characteristic of the rhythmical perception, possible. 3. We compare the sensations in the series as to stress. Stress may be objectively brought about by temporal, intensive or qualitative changes,—in short by any change which marks or differentiates one member of the series from another. We judge of stress by the claim that it makes upon the attention. It may be subjectively brought about by a regularly recurring increase of attention. 4. For a comparison of two or more members of a series, it is necessary that they fall within the bounds of immediate time perception. One group corresponds to one pulse of attention, and the regularity of the subjective rhythm is due to the regularity with which the pulses of attention succeed one another. When several groups can be reproduced as a whole, they may be said to fall within the limits of immediate time perception. 5. The peculiar effectiveness of rhythmical perceptions arises from their tendency to set up sympathetic vibrations over the whole body,

¹ Text Book of Physiology, edited by E. A. Schaefer, 1900. Vol. II, p. 708.

² *Op. cit.*, p. 2690.

more especially from their reinforcement by organic sensations. These sensations of like phases from the different modalities fuse to a total perception. The alternation of these perceptions we term a rhythmical perception. A perception of rhythm, then, is never a perception of successive sensations, but a perception of successive perceptions, each of which arises from a fusion or summation of sensations coming from different sense continua, but whose vibration times have like phases. 6. Because of the organic rhythms, the perception of rhythm is regarded as peculiarly subjective. We are ordinarily accustomed to refer a complex of sensations to an external object; but with rhythm the sympathetic bodily vibrations cause us to regard it as more subjective. 7. The unitary character of a rhythmical group is dependent upon its unity for perception. This is dependent upon a subordination among the parts. The greater the unity for perception, the greater is the effectiveness for reproduction. Cf. Hoeffding:¹ "The more gradations, the more definitely stamped features and relations a mental state exhibits, the better it can be recalled to memory." 8. The limit of the possible number of separate elements in a group is determined by the limitations of the intensive sensible discrimination. 9. Introspection does not warrant the position of two hypothetical forces, one directed forward, the other backward; or the presence of alternate feelings of strain and relief. What we do find by introspection is a constant forward direction of the attention. The apparent discontinuity in a rhythmic series is conditioned by the discontinuity in the successive acts of attention. The normal span of an attention wave varies with the unity and continuity of the object of perception. "Er steigert sich mit zunehmendem Sinn." "Continua haben ein grösseres Aufmerksamkeitsfeld als Discontinua." The attention rhythm was well characterized by a subject of Zeitler in an investigation of the range of attention.² "Er konnte auch Intervalle, Hebungen und Senkungen der Aufmerksamkeitswelle constatiren. Die Aufmerksamkeit 'hupfte' nach seinen Angaben über die dominirenden Buchstaben in Complexen, auf letzteren länger haftend, als auf den unbetonten Strecken. Bei grösseren Zeiten gleitet die Aufmerksamkeit ruhig über die Reihenfolge der Elemente hinweg." Rhythmical grouping may then be compared to a succession of waves. (a) The single group corresponds to one wave—an immediate act of attention. (b) The parts of a group correspond to different points in a wave; the accented tone being on the crest. (c) The pause is the zero

¹Outlines of Psy., Eng. Trans., p. 241.

²Tachistoskopische Versuche über das Lesen, Phil. Stud., XVI, p. 408.

point in the advancing wave. It is the time when, in the change of attention, "wir nichts in uns vorfinden," as Eberhardt¹ expresses it. 10. An analytical attention is destructive of rhythmical perception; the function of attention in the perception of rhythms is synthetical. 11. If the single impressions are separated by a greater span than that covered by one wave of attention, each impression stands alone; under regular conditions in this case primary rhythm arises. If the rate is too rapid, then there is no perception of rhythm. There is only a regular rising and falling in the intensity of what approximates a continuous sound. Bolton believes that this is because the rate is too rapid to find muscular expression. It is much more probable that perception of rhythm fails because the rate exceeds the upper limit of the cortical rhythm.

§ 5. THE INFLUENCE OF AN ACCOMPANIMENT UPON TEMPO.

The question of the influence of an accompaniment upon the tempo of the rhythm has been directly studied by Eberhardt (here the accompaniment was instrumental), indirectly by Miss Smith in her experiment as to the effect of rhythm upon work,—the metronome gave the time in this case,—and by Buecher. The latter, in his *Rhythmus und Arbeit*, has given a wealth of illustrative material derived from anthropological sources. He instances not only cases in which rhythm of movement is accompanied by song or instrument, but also cases in which individuals accompany each other. The present results show only the influence upon the time when individuals accompany each other.

Chorus reading. In the first experiment, immediately after the individual readings, the five members of each section were asked to give the different rhythmical forms in chorus.

In general, the time of chorus reading is longer than the average for the individual reading; but there are numerous exceptions, especially in the case of the German children, whose results at first seemed very irregular.

An accompaniment appears to have two functions: (a) regulative, and (b) excitatory. *Regulative.* when an accompaniment serves as a regulator it may either decrease or increase the normal rate. The rate of speed will be increased when the standard or leader has a rate exceeding that of the separate individuals. It will be decreased when the individuals are relatively independent of the leader, *i. e.*, when several could equally well lead. In other words, the rate is decreased in proportion to the uncertainty or irregularity of the standard. The tone of the leader, like the beat of a metronome, sets the pace.

¹ *Op. cit.*, p. 106.

TABLE LIV (a).
Chorus. Boys. American.

TROCHEE.		IAMBUS.		DACTYL.		ANAPEST.		
Av.	Cho.	Av.	Cho.	Av.	Cho.	Av.	Cho.	
23.02	27.	30.4	30.	*29.5	*24.	*30.7	*20.	I. Class.
24.7	*17.2	26.7	*17.	28.3	17.2	24.1	15.	
21.3	22.5	22.2	*19.	22.5	20.	21.5	20.	
20.9	24.	23.3	*24.	22.8	23.	22.6	22.	
24.1	*16.	23.3	*18.	23.1	21.4	21.7	18.	
22.8		25.1		25.24		24.1		
M.V.	21.3	M.V.	21.6	M.V.	21.1	M.V.	19.	
1.36	M.V.	2.6	M.V.	2.94	M.V.	2.68	M.V.	
	3.8		4.28		2.02		2.5	
15.4	22.	16.7	22.	16.1	20.	15.1	*22.8	IV. Class.
14.7	17.	16.2	17.	15.5	*15.	14.45	18.5	
15.9	18.2	14.9	20.	14.1	19.	13.5	18.	
14.7	21.	15.2	21.5	13.2	20.	14.6	21.	
15.4	18.	15.2	18.	14.5	16.4	13.	17.2	
15.2		15.6		14.6		14.13		
M.V.	21.24	M.V.	19.7	M.V.	18.08	M.V.	19.5	
.42	M.V.	.64	M.V.	.88	M.V.	.68	M.V.	
	2.3		2.2		1.9		1.7	
14.45	18.	14.2	16.	13.2	16.4	11.05	16.4	VII. Class.
12.7	18.	13.1	17.	12.	15.	11.5	13.	
13.	20.	13.9	18.	11.2	17.	11.5	18.	
13.5	14.	12.4	15.	12.	14.	11.6	12.	
15.2	22.	14.5	21.	12.6	20.	12.6	17.	
13.7		13.6		12.2		11.65		
M.V.	18.4	M.V.	17.4	M.V.	16.48	M.V.	15.28	
.77	M.V.	.74	M.V.	.56	M.V.	.38	M.V.	
	2.08		1.68		1.61		2.02	

*Failure to produce rhythm.

†Imperfect.

‡Notice time.

Now if the time of the leader is no faster than that of the other members, there is also slowing of the individual times due to the fact that each waits for the other or for the leader. This is characteristic of the results in general. Miss Smith observed two stone masons working together, and found that though they were apparently working faster, the tempo was in reality slower than when each worked alone. Buecher divides work into two classes, "Arbeit in Gleichtakt" and "Arbeit in Wechseltakt."¹ He defines the function of the first as regula-

¹ *Op. cit.*, pp. 130 ff.

TABLE LIV (b).
Chorus. Girls. American.

Trochee.		Iambus.		Dactyl.		Anapæst.		
Av.	Cho.	Av.	Cho.	Av.	Cho.	Av.	Cho.	
23.1	*18.16	22.3	*20.	22.4	*17.	22.	*18.	
18.7	19.	17.5	17.	16.7	17.	20.	18.	
19.4	18.	19.9	18.	18.6	29.	19.1	19.	
17.9	18.	21.2	21.	16.9	18.5	17.2	19.	
21.	18.	20.4	21.	17.1	19.	17.8	18.5	
20.02		20.6		18.3		19.2		
M.V.	18.23	M.V.	19.4	M.V.	20.1	M.V.	18.7	
1.76	M.V.	1.22	M.V.	1.76	M.V.	1.24	M.V.	
	.32		1.52		3.5		.44	
23.1	26.	19.7	24.5	19.3	21.	21.3	*21.	
19.5	‡18.	20.7	19.2	18.5	‡18.	16.5	‡16.	
16.9	17.	17.5	19.	15.2	‡14.2	14.6	16.	
14.6	18.	16.05	17.5	13.7	15.	13.8	‡13.	
15.8	16.	17.5	17.5	13.3	16.	14.1	15.	
17.9		18.23		16.		16.06		
M.V.	19.	M.V.	19.5	M.V.	16.8	M.V.	16.2	
2.24	M.V.	1.31	M.V.	2.3	M.V.	2.61	M.V.	
	2.6		1.96		2.1		1.3	
18.8	21.	18.8	19.	16.5	‡17.	15.5	19.	
19.1	20.	16.8	19.5	16.1	18.5	15.1	17.6	
18.4	18.5	18.3	19.	15.7	19.	16.	17.	
§19.	‡18.	17.5	17.5	15.5	17.	14.3	16.	
17.3	18.	17.5	18.	16.	‡15.2	15.2	17.5	
18.5		17.8		15.96		15.2		
M.V.	19.1	M.V.	18.6	M.V.	17.3	M.V.	17.4	
.74	M.V.	.62	M.V.	.24	M.V.	.42	M.V.	
	1.1		.68		1.1		.74	

§ Times of all individuals unusually long.

¶ Here Marjorie and Annie have much quicker time than others. Shows more in chorus.

† There is a lengthening of average time which brings about incongruity quite as much as the shortening of the chorus time.

tive. It holds the company to the same time and calls for an equal expenditure of energy from each of the workers. Though he gives us no data¹ as to the comparative times, we should probably find it slower than the individual times. The work for each individual is in this case increased; he must not only attend to his own, but also to his companions' tempo.

¹ Buecher does not appear to recognize the fact that the use of an accompaniment may bring about a retardation of the normal rate.

TABLE LIV (c).
Chorus. Boys. German.

TROCHEE.		IAMBUS.		DACTYL.		ANAPEST.		I. Class.
Av.	Cho.	Av.	Cho.	Av.	Cho.	Av.	Cho.	
26.75	28.	32.25	29.	21.75	25.	24.25	30.	
28.2	27.	27.4	25.4	25.9	23.8	27.5	33.	
28.5	32.	27.6	29.	24.8	24.	24.1	27.6	
27.81	29.	29.08	27.8	24.15	24.26	25.27	30.2	
M.V.	M.V.	M.V.	M.V.	M.V.	M.V.	M.V.	M.V.	
0.72	2.	2.06	2.26	1.72	0.48	1.47	1.8	
20.5	21.	21.	21.5	18.05	17.	18.75	24.4	
20.2	19.	19.5	20.	18.2	18.	18.7	21.	
20.	21.	21.8	20.	18.8	17.	18.5	17.4	
20.23	20.5	21.22	20.5	18.35	17.33	18.65	20.9	
M.V.	M.V.	M.V.	M.V.	M.V.	M.V.	M.V.	M.V.	
0.26	0.63	0.84	0.66	0.3	0.44	0.10	2.3	
22.8	27.	21.2	26.	19.8	23.	19.6	28.	
21.5	22.	22.1	23.6	19.33	18.8	20.2	26.	
21.08	21.	19.8	21.	15.8	15.4	18.05	23.4	
22.06	23.	21.03	22.2	18.31	19.06	19.28	15.8	
M.V.	M.V.	M.V.	M.V.	M.V.	M.V.	M.V.	M.V.	
0.46	2.33	0.88	3.4	1.67	2.55	0.85	1.6	

Regulation at an increased rate. With the younger children especially, the inherent difficulties of some of the rhythms caused a retardation in the individual time; but when they read in chorus the leader, always the most rhythmical, carried the others along at a rate considerably faster than their natural tempo. The work of each individual was decreased; *i. e.*, instead of being obliged to find the rhythm for themselves, which would involve a comparison, more or less difficult, of a series of perceptions, their attention was directed solely to the tone of the leader. They were thus able to give the rhythm at a rate which would have been impossible to them unaided. The same thing was observed with the older children; for example, the German girls of the seventh grade. The leader read very rapidly and surely; the result was that while the chorus time

TABLE LIV (d).
Chorus. Girls. German.

Trochee.		Iambus.		Dactyl.		Anapæst.		I. Class.
Av.	Cho.	Av.	Cho.	Av.	Cho.	Av.	Cho.	
27.26	33.	30.3	33.	27.3	26.	30.66	34.	
32.7	35.	31.7	39.	29.3	33.	30.	31.2	
30.8	30.	29.6	32.	26.3	25.	30.	27.	
31.7	32.7	30.5	34.66	27.6	28.	30.22	30.7	
M.V.	M.V.	M.V.	M.V.	M.V.	M.V.	M.V.	M.V.	
2.	1.7	0.73	2.8	1.1	3.33	0.29	2.5	
22.52	24.	19.84	20.	19.3	19.	19.53	21.	IV. Class.
21.4	19.	20.7	16.	16.9	13.6	17.14	16.2	
21.2	19.	21.	17.4	17.	14.	17.6	13.	
21.7	20.6	20.51	17.8	17.7	15.5	18.09	16.7	
M.V.	M.V.	M.V.	M.V.	M.V.	M.V.	M.V.	M.V.	
0.54	2.2	0.45	1.46	1.03	2.3	0.96	2.8	
20.96	17.	20.62	16.	17.36	17.	16.6	11.	VII. Class.
18.76	17.	18.7	17.5	17.1	17.2	15.5	16.	
19.5	19.	18.3	16.	15.6	16.	15.9	17.	
19.74	17.6	19.2	16.5	16.68	16.7	16.	14.66	
M.V.	M.V.	M.V.	M.V.	M.V.	M.V.	M.V.	M.V.	
0.81	0.86	0.94	0.66	0.72	0.5	0.4	2.44	

was slower than her own it was faster than the natural time of the other individuals in the chorus. The results which Miss Smith¹ gives for work to the accompaniment of the metronome would fall under this head. The standard in this case had absolute regularity and stability, and served as a director of the attention; thus the majority of the subjects were enabled to accomplish more than when working alone although, as Miss Smith further remarks, the quality of the work suffered. The majority of the subjects preferred also that the metronome should give a time somewhat faster than their normal, rather than slower.

When a rhythmical accompaniment of *constant tempo* is em-

¹ *Op. cit.*, pp. 82, 94, 284, 280.

ployed to regulate a *prolonged* activity, the result is that the total time taken is less than it would have been had the activity been unaccompanied. This case naturally did not arise in the experiment as given here. But Buecher appears to regard it as typical of the affect of the employment of an accompaniment. A quicker tempo, as he believes, results even when the accompaniment possesses no more regularity than that given by a fellow worker. "Der Einzelne lässt die Hände sinken oder verlangsamt das Tempo der Bewegungen, wenn er müde wird. Die gemeinsame Arbeit regt zum Wetteifer an."¹ It is doubtful whether the rhythmical accompaniment would in such a case act as an excitant; and, if regulative in function, whether the *irregular* accompaniment would not really result in a slower tempo even though to the casual observer there might be an apparent increase in rate.

Eberhardt² concludes that an accompaniment shortens the time, although his subjects were inclined to judge the rhythm unaccompanied as more rapid. The illusion follows naturally from the same cause as the shortened time. It is first to be noted that the standard in Eberhardt's experiment possessed the requisite regularity and constancy. The attention was directed upon the tones of the accompaniment; and the musician in place of making a series of time judgments attended only to the tones of the accompaniment as they succeeded one another. Eberhardt's explanation is that "der Musiker spielt ein Musikstück mit der Geschwindigkeit bei welcher die Gefühlswirkung, welche er erwartet, sich am deutlichsten einstellt; an ihr hat er einen Massstab für die Geschwindigkeit." Now if he plays with an accompaniment, the feeling rises more quickly, and thus less time is taken for the production of the piece. The time taken for playing the same piece upon a silent piano is still greater than that taken to play without an accompaniment. This Eberhardt explains as the result of the greater psychological activity involved and the retardation in the arousal of the feelings, in terms of which the player judges the rate of succession. But these instances seem rather to be examples of the increased difficulty in the estimation of time when the number of criteria, in terms of which a judgment is made, is decreased. *The fewer the criteria and the less their constancy, the more difficult is the estimation of time and the slower the rate of succession.*

Excitatory. The chorus reading in this case was always faster than the average time of the individuals. When all difficulty in the production of the rhythms had disappeared, the

¹ *Op. cit.*, p. 31.

² *Op. cit.*, p. 149.

children acted as a spur to each other in their reading. This was true of the German girls of the fourth grade as well as of the American classes upon occasion. The manner of reading was very different from that found in the first instance. The rhythm grew more rapid as they proceeded; there were also evident signs of extreme pleasure, and a noticeable tendency to accompany the rhythms with various movements of hands, feet, etc. It seemed to partake more of the nature of the rhythmical exercises of the primitive peoples. Buecher cites numerous cases of 'Arbeit in Wechseltakt' in which rhythm has this function. Here, he finds that the social feelings, desire to outdo one another, etc., predominate in contrast with 'Arbeit in Gleichtakt' in which the regulative function was most prominent. In these instances, in which rhythm is an excitant, the activity has become automatic and the attention can be freely directed to the pleasurable accompaniment.

CHAPTER IV. THE NATURE OF RHYTHM.

The generally accepted definitions of rhythm emphasize the affective side. Wundt¹ defines it as a complex feeling which can under certain conditions pass over into an emotion. "When the feelings produced by rhythmical impressions become more intense, as is usually the case, especially when the rhythm is connected with sensational contents that arouse the feelings greatly, they become in fact emotions." In this feeling complex Wundt distinguishes two factors, (a) partial feelings, and (b) the unitary total feeling which is a resultant of the manner of connection of partial feelings. "These partial feelings are here the feelings of strained and fulfilled expectation which in their regular alternation constitute the rhythmical time ideas themselves."² These feelings mediate the grouping of what would otherwise be only a series of disconnected impressions. The feeling of strain or rising expectation (both terms have been used) fills the interval between two successive auditory or tactal impressions; the feeling of fulfilled expectation or satisfaction marks the completion of the interval. Thus rhythm owes its integral nature and essential character to the interplay of these two opposed feelings.

Eberhardt³ criticised Wundt on the ground that introspection did not reveal the presence of these two feelings. In place of fulfilled expectation he found only an absolute emptiness of content ("Bewusstseinsleere"). He also objected to the term "rising" expectation; it is not happily chosen, since expecta-

¹ Outlines, Eng. Trans., p. 169.

² Outlines, Eng. Trans., p. 167.

³ *Op. cit.*, p. 106.

tion, in its usual signification, is directed upon an object. But there is no such direction in the case of rhythm. If expectation is used to connote a feeling resulting from the complex made up of sensations of strain and centrally excited sensations, then the distinction between expectation and strained attention is broken down. He would therefore substitute a "feeling of attention" for the Wundtian term "rising expectation." "Die Qualitätsungleichheit wurde dann darin bestehen dass einmal ein Gefühl der Leere, wenn der Ausdruck gestattet ist, das andere Mal das Gefühl einer bis zu gewisser Spannung zunehmender Aufmerksamkeit vorhanden ist." In addition, under certain circumstances, a weak feeling of activity and of pleasantness may be found; but to these feelings Eberhardt would ascribe a very minor part.¹

We must take exception to the terminology of Eberhardt; what he has really done is to make attention mediate the sensation. The feeling of emptiness is nothing but the period of inattention between the successive waves of attention. Why, then, is it necessary to adopt a questionable terminology to express undoubtedly facts of introspection? It was, probably, in order to give an explanation for what Eberhardt considered qualitatively unlike experiences, by the introduction of two qualitatively different feelings. But this is unnecessary; for the changing sensations give a sufficient explanation for whatever qualitative differences introspection may find in the perception of rhythm. Moreover, 'feeling of attention' is scarcely a legitimate use of the term. Had Eberhardt omitted the term 'feeling' he would have given a satisfactory explanation of the facts of rhythm as introspection reveals them.

Ettlinger objects to Wundt's use of "strained and fulfilled expectation," (1) because the changing strain sensations are from their great variability an unsuitable basis for the "eineheitlichen Gefühlsverlauf." (2) The "feeling of fulfillment" would not sink as suddenly as is demanded by the terms of the theory. (3) The pauses might just as well be awaited as the sounds. For these feelings Ettlinger substitutes two forces, a positive, which presses forward, and a negative, which opposes the action of the first.² "In der Isolirtheit und kurzen Nachdrücklichkeit der einzelnen Schläge; da diese nun aber auch die Träger des zeitlichen Zusammenhangs sind, . . . bilden sie die Ansatzpunkte beider Kräfte." When we attempt to find adequate psychological terms for these two forces, it appears that Ettlinger has only thrown the familiar facts of the oscillation of attention into figurative language; what we really have

¹ *Op. cit.*, p. 106.

² *Op. cit.*, pp. 175 ff.

is an explanation in terms of attention. The positive force, 'fortschreitende Tendenz,' is nothing more than a direction of the attention forward. As Groos¹ says: "Die vorwärtsstrebende Kraft aller rhythmischen Wiederholungen, besonders der musikalischen und poetischen Rhythmen, dieses unwiederstehliche Weiterdrangen dem wir uns so willig hingeben, ist Nichts anderes als die immer aufs Kommende gespannte Aufmerksamkeit." And the phenomena which Ettlinger explains by the action of the second force are nothing other than the objective and subjective stresses, which those sensations or perceptions receive which become the focus of attention.

Other objections might be urged against the Wundtian definition. (1) Expectation could play no part between successive impressions which follow each other at a rate which would give rise to a perception of rhythm. This objection was raised by Külpe² to the hypothesis that expectation and surprise mediate the estimation of short time intervals. The same objection applies here. (2) If expectation mediated the grouping, it would be hard to explain the distinction between the temporal character of the grouping produced by the younger and the older children; it would be the reverse of what it is, for the incapacity of children to sustain a long suspense would make the rhythm more rapid for the younger than for the older. As a matter of fact, the times of the younger are much slower, the intervals longer. (3) We should also expect, if expectation played any part, that the iambus and anapæst would be shorter than the trochee and dactyl. But the opposite is true. (4) The breathing curve does not show the characteristics of an expectation curve. "Bei der Erwartung, besonders wenn diese als 'gespannte' Erwartung hervortretend ist, wird eine Erhöhung der willkürlichen Innervation nebst einem Spasmus der organischen Muskeln wahrgenommen" (Lehmann).³

The only other recent attempt to define rhythm has been that of Miss Smith⁴ who in the main follows Meumann and Wundt. She defines it as an emotion, "dessen motorischen (und damit zum Theil auch die vasomotorischen) Aeusserungen und Entladungen sich nicht vollkommen frei ergeben können, wie beim gewöhnlichen Affectverlauf, sondern dessen Ausdrucksbewegungen nach einem bestimmten Schema zeitlich und intensiv geregelt sind." While this definition does not add anything that was not implicit in the Wundtian defi-

¹ Die Spiele der Menschen, Jena, 1899, p. 183.

² *Op. cit.*, p. 405.

³ Die Hauptgesetze des menschlichen Gefühlslebens, Leipzig, 1892, p.

^{312.}

⁴ *Op. cit.*, p. 291.

nition, it ignores the perceptual elements, which Wundt does not. Miss Smith goes so far as to declare that rhythm disappears when the affective tone becomes unpleasant.¹

No explanation which makes the affective elements fundamental to rhythm can be satisfactory. (1) Introspection shows that rhythmical grouping can occur in a perfectly indifferent conscious state. This was noted by the subjects of Bolton and Smith as well as by our own. (2) Feelings become blunted by repetition. If then, rhythm originates in the partial feelings, which Wundt makes intermediaries in each and every group, we should expect a gradual weakening of the affective tone of rhythm with prolongation of rhythm; but this is not true. As a rule, the affective tone generally increases for a considerable length of time, especially when organic co-vibrations are set up. (3) The feeling, when present, does not consist of a series of contrasted feelings, such as any theory which makes feeling the intermediary of grouping must presume; on the contrary it runs a comparatively unbroken course of either gradually increasing pleasantness or, when reversed, of gradually decreasing pleasantness. The contrast brought out in grouping is ideational in source. (4) No explanation of rhythm which goes out from the feeling side can successfully explain the limitations which all groupings show (the limitations to the two and three grouping and their compounds). (5) The gradual growth of rhythmical ability and rhythmical perception can be accounted for only on the grounds of its perceptual nature. (6) The characteristics of the affective curve are not present in the rhythmic curve taken by the pneumograph. The curve, as has been shown, is that characteristic of an attentive state. (7) Furthermore, all the phenomena of rhythm can be explained by the facts of perception.

How then are we to account for the presence of feeling? For it is not to be denied that feeling is often an accompaniment of rhythmical perception. In this connection, the data which were given by the adult subjects, as to the affective tone of the rhythms given by the different discs, are interesting.

¹"Wenn das Gefühl, welches durch taktmässige Bewegungen erregt wird, nicht angenehm ist, dann ist der Rhythmus (wie wir das Wort gewöhnlich verstehen) nicht vorhanden, sondern vielmehr ein Bewusstsein von Dissonanz und Unbequemlichkeit," *op. cit.*, p. 287. Introspection contradicts this statement.

Titchener (Experimental Psychology, Vol. I, Part 2, p. 353) calls attention to Meumann's evident change of view. In Meumann's own work he emphasizes the perception side of rhythm, pp. 272 f., 284, but Miss Smith, whose manner of treatment of rhythm was evidently influenced by Meumann, defines it as an emotion, as the passages above quoted show.

B. B. The regularity of the sounds is pleasant.

I. M. describes Disc 5 as pleasant and enlivening.

S. says that 7 is pleasant, reminds of dance music.

B. B., that rhythm with the forks having an interval of the minor third is pleasanter than with the former forks.

F. W. says "Disc 6 is rather pleasant; it reminds me of calling some one." Disc 9 was unpleasant.

E. P. finds Discs 1 and 7 pleasant by association with sounds of machinery. All the other discs are unpleasant. She says later: "None of the combinations are pleasant; some are even unpleasant; affection seems to have worked off from the combinations which were at first pleasant. While in the case of the combinations at first indifferent, their perception is now unpleasantly toned." With E. P. objectively conditioned rhythms are unpleasant; the pleasantness seems to be due to associations; these are more readily called up with the more flexible forms, *i. e.*, those she can herself arrange.

E. V. B. finds Disc 2 disagreeable, as some borders with straight lines. (The affective tone is here given by a visual association.) She also finds the two-group discs colorless and unpleasant by contrast with the three-group preceding. Disc 2 is pleasant, the high tone particularly so because of the singing quality. In comparing Disc 5 with Disc 1 she says: "It is much pleasanter, brighter and quicker. (1) was heavy."

Unpleasantness arises where the natural subjective grouping is obliged to overcome a strong objective rhythm. E. V. B. found Disc 8 unpleasant for this reason. (8 and 9 for all subjects were less pleasant than 6 and 7. The objective conditions were too strongly marked, there was less chance for the free play of the individual tendencies, and there were often resistances to be overcome.) For this same reason F. W. finds Disc 3 not as pleasant as 2.

The facts brought out by these replies are: (1) Feeling is not essential to the perception of rhythm. E. P., who is susceptible to all of the illusions, finds the rhythm pleasant only when associated with the familiar sounds of the factory town in which she spent her youth. How can a satisfactory aesthetic of rhythm be based of the facts of rhythmical illusion,—the supposition being that subjects susceptible to the illusion take pleasure in rhythm? This is the basal supposition of Ettlinger's whole treatment of rhythm; yet it is not warranted by introspective evidence. The illusions have their ground in the facts of sensation and perception, and not in those of affection. (2) Pleasantness is very frequently of an associative character. (3) In instances where the pleasantness seemed to attach to the rhythm *per se*, the three-group was said to be pleasanter than the two-group because it was 'richer,' 'brighter.' Those succeeding each other quite rapidly were pleasanter than those having a slower rate. Regularity of sound was found to be pleasant. These instances can all be subsumed under the rule that a rhythm which is moderately stimulating is pleasant. (4) In the same connection it is interesting to note what forms were found to be especially unpleasant. These were Discs 8, 9, 3 and 4. Here the objective conditions of the rhythms are very

marked. When the form came in conflict with a natural grouping, the rhythm was unpleasantly toned.

Some writers, as Lipps¹ and Groos,² emphasize the associative factor. But such explanations make the affective tone arise from factors extraneous to the rhythm.

Though the associative feelings are no doubt often present, they do not explain the strong feelings that the perception of rhythm is often able to produce; for example, the cases of ecstasy in the rhythmic dancing of the primitive peoples and in the religious services of the Southern negroes. We must look for feelings which arise from the very nature of rhythm. These can be of two kinds, the feelings that accompany the simple sensations, *i. e.*, the simple sense feelings, and those which arise from the connection of these sensations, the aesthetic feelings. In nearly all perception of rhythm, the simple sense feelings are undoubtedly stronger than the aesthetic. The pleasantness arises from the moderate and regular functioning of the bodily organs and the resulting stimulation of the cortex. A moderately rapid rate of succession was found to be pleasanter than a slow. Pleasantness was increased when movements accompanied a sensory rhythm, *i. e.*, when other centers were excited together with the auditory. Hoeffing³ says: "Any sound naturally affords pleasure merely because it sets in action the organs of hearing. The deafening music of children and savages gratifies nothing but this impulse in the organ toward stronger function."

The great pleasure which children find in rhythm is due to the efficacy of rhythm to set up vibrations in other organs of the body, and the consequent harmonious activity of the several bodily organs. The affective tone increases in proportion as the summation of excitation increases, till a state bordering on ecstasy may be reached. Ecstasy, when it follows upon rhythmical stimulation, is due to a spreading of the excitations to a greater and greater number of centers, till the body and the whole of consciousness are set in co-vibration. At such times the rhythm has become automatic, and the attention is directed solely upon the sensations accompanying the diffused bodily movements.

When an auditory rhythm has become so familiar that the excitation is insufficient to cause diffusion, and the resulting stimulation of the cortex is weak, the rhythm is indifferent.

The rhythm will become unpleasant if the rate of succession exceeds the natural rate of the individual.⁴ When the rhythm

¹ *Ästhetische Einfühlung*, Zeits. Psych., XXII, pp. 441 ff.

² *Op. cit.*, p. 33.

³ *Outlines of Psychology*, Eng. Trans., p. 231.

⁴ Miss Smith notes such a case, *op. cit.*, p. 124.

is too complex to be readily perceived, unpleasantness may also attach to it. The demand made upon the cortex in such a case exceeds its normal capacity for function. Of the same nature is the unpleasantness which arises when an objective rhythm through the lengthening of one tone and accenting of another disturbs the normal activity.

The æsthetic effect of the rhythm is not due, as Wundt remarks, to a summation of the sense feelings, but arises from the manner of connection of these sensations. One arrangement of intensities is pleasanter than another because it increases the unitariness of the total impression and its efficacy for reproduction.¹ The various possible arrangements of the objective factors, temporal, intensive and qualitative, have a greater or less æsthetic value according to the approximation of the resultant impression to a unitary character. Here is another instance of a pleasantness arising from the perception of unity in the manifold. It is doubtful, however, if the pleasantness which children find in rhythm is ever of this type. Generally, they had no preferences as to arrangements. When a truthful report upon the pleasantness of the different rhythms was given, the trochee was commonly preferred because it was easier to get. This was clearly not an æsthetic judgment. The pleasantness of the rhythm arose for them, undoubtedly, from resulting bodily activities.

¹ Cf. Külpe's treatment of æsthetic feeling, *Grundriss*, p. 264.

IMPROVEMENTS IN THE VERNIER CHRONOSCOPE.

By E. C. SANFORD.

While the vernier chronoscope as described in Vol. IX of this *Journal* has given general satisfaction, continued use of it has suggested several improvements, some of which have been embodied in two new models of the instrument. Model I has been given a convenient device for adjusting the pendulums at their proper lengths and a new and solider sort of releasing key, without radical change in the general form of the instrument. Model II has these improvements and also a double release key for the shorter pendulum, adapting the instrument to experiments involving discrimination and choice, and an elec-

MODEL I.

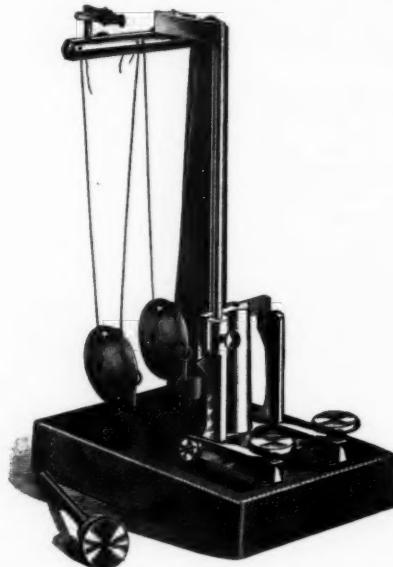


Fig. 1.

trical contact in connection with the release key of the longer pendulum, which greatly increases the variety of stimuli that can be used with it. These changes have involved a considerable remodeling of the instrument.

Adjustment of the Bobs. It will be noticed in the accompanying cut of Model I that both bobs and the supporting post at their right are pierced with sizable holes. The upper one of the holes in the post is bored at such a point that when a close fitting rod is slipped through it and through the hole in the bob of the short pendulum the latter will have its proper distance from the edge of the bar from which the pendulums hang. The lower hole is similarly placed with reference to the bob of the long pendulum.

To hang the bobs at their proper distance all that is necessary is to slip the rod through the appropriate hole in the post, slide on one of the bobs till it reaches its proper position, pass the thread twice through the small hole in the bob, draw the threads straight and withdraw the rod.¹

Keys and Releasing Apparatus. The improvements in this part of the apparatus consist in bringing the keys much nearer the base and in making them more solid. The need of vertical adjustment has been obviated by careful construction. The links, which in the old form of the instrument were separate and liable to be lost, are now permanently attached to the bobs. Among minor points of improvement may be mentioned the increased weight and larger surface of the base, the better shape of the bobs and supporting bar, a simplified means of fastening the threads, the placing of the holder for the stimulus card on the bar from which the pendulums hang,² and the attachment of the screen holder to the operator's key by a socket and set-screw.

¹If the setting of the bobs is to be the same from time to time it is necessary of course that the threads be drawn up each time with the same degree of tension. It is clear also that any error in the position of the holes in the post and any looseness of the rod in the holes will affect the length of the pendulums, though when the threads are drawn tight the latter is not important. The holes, however, are placed with care and the errors arising from this source are small, and perhaps for practice work might be wholly neglected. Where more exact results are desired the swings may be counted and the pendulums adjusted by count, or an arithmetical correction applied as explained in the *American Journal of Psychology*, Vol. IX, p. 194, and in Titchener's *Experimental Psychology* (Instructor's Manual), p. 213.

²This improvement, which has been used in a considerable number of instruments of the old model, was suggested by Miss Hattie E. Hunt, late of the Rhode Island State Normal School, Providence.

MODEL II.



Fig. 2.

The instrument in the form just described has a tolerably wide field of usefulness, as may be seen by consulting the original description in this *Journal* or Titchener's *Primer of Psychology*, pp. 182 ff. It does not, however, lend itself easily to experiments requiring the discrimination of two stimuli and the choice of a reaction appropriate to one or the other, nor does it allow the taking of simple reactions with stimuli of variable character, intensity or place, nor, in a very satisfactory way, of those with visual and electrical stimulation. These are all made possible by the addition of a second key to the releasing apparatus of the shorter pendulum and of electrical contacts to the release key of the longer pendulum. The instrument in this form is shown in Fig. 2. The pendulums, supporting bar and post are like those of Model I, and the base differs only in being about an inch wider. The new release mechanism made necessary by the doubling of the short pendulum key (and used in this instrument for the long pendulum also) will be readily understood from Fig. 3, which shows it in section as used for the latter.

The link of the pendulum is held between a sloping boss and

the conically hollowed head of a plunger, the plunger being kept down by a spring. When the key is pressed the plunger is raised and the link released. The mechanism is the same in the case of the short pendulum, except that the ends of both keys come under the foot of the plunger, so that if either is pressed the plunger is raised and the pendulum released.

The electrical contact fitted to the operator's key is of very simple construction. One contact surface is placed on a spring on the upper side of the key and the other on the point of a

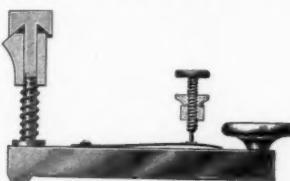


Fig. 3.

screw above it. The lower contact is placed on a spring in order to insure good electrical connection without interfering with the grip of the plunger on the link of the pendulum. The electrical circuit leads through the spring, the body of the key and the base to a binding post attached to the latter. The upper contact is of course connected with a binding post which is insulated from the base. By means of these binding posts the operator's key may be brought into the primary circuit of an induction coil, which on the depression of the key will be broken at the same instant that the long pendulum is released. By the use of the induction coil thus introduced are made possible the various forms of experiment mentioned above. When, for example, the secondary terminals of the coil are connected with a Geissler tube, the apparatus can be used for simple reactions to visual stimuli; when connected with suitable electrodes, for reactions to electrical stimulation of the skin; and when connected with a telephone, for auditory stimuli of a very convenient kind. If the induction coil is of the sliding pattern common in physiological laboratories, stimuli of varying intensity of any one of these sorts can be given by changing the distance of the secondary coil from the primary. Stimuli in variable place can of course be obtained by putting in several Geissler tubes, pairs of electrodes, or telephones in parallel circuit, and using one or another without the previous knowledge of the subject.

The change in the releasing mechanism necessitated a change in the clips for holding the stimulus card and the screen. The

former is placed on a short post on the base near the left end of the operator's key, and the latter is attached to a cam on the opposite side, which is turned by the depression of the key. These clips are shown without the card and screen in the general view, Fig. 2.

With an instrument of this pattern all the more important experiments upon the time relations of mental phenomena are possible, except those requiring the exact measurement of the time elapsing between a spoken stimulus word and a spoken reply by the subject; and even here, with a little practice the operator can learn to depress his key at the giving of the stimulus word (and the subject his key at the giving of his reply) with ample exactness for all purposes of demonstration and even of research.

FLUCTUATION OF THE ATTENTION TO MUSICAL TONES.

By E. B. TITCHENER.

Dr. Heinrich found, in 1898, that minimal tones do not fluctuate ("dass bei Tönen keine Intensitätsschwankungen zu beobachten waren;" see this *Journal*, October, 1899, XI, 119). The tones employed were the high tones of a Galton whistle, and tones from the middle and lower regions of the scale given by organ pipes and wide glass tubes.

In 1899, H. O. Cook, working under my direction, found that fluctuation occurred with the Politzer acoumeter (c^2), with an electro-magnetic fork of 512 vs., and with a blown bottle whose tone was approximately that of 256 vs. (*ibid.*, 123).

Dr. Heinrich replied in 1900 (see this *Journal*, April, 1900, XI, 436) that Cook's fluctuations were due to "bruits à peine perceptibles." He also published the results of experiments on perfectly pure tones (the tones of singing flames, placed under certain physical controls), which showed no fluctuation.

We obtained a gas harmonica from Kohl, and standardised the two lower tones as Dr. Heinrich prescribed. The experiments were made under my direct supervision: experimenter, Miss J. A. Cochran, a graduate student in the Psychological Department; observers, Mr. J. D. Speer and Miss E. Parry. Of these, J. D. S. had had special practice with minimal stimuli, and had observed their fluctuation, in various sense departments; E. P. had had only general practice in introspection. Ten series of observations were taken from each observer. *There was no fluctuation.*

I regret that the experiments could not be carried farther. But it is only fair to Dr. Heinrich to publish this confirmation of his statement. The fact (if it prove to be a fact, on farther test) is one of high theoretical importance. The fluctuations have been proved to be independent of peripheral conditions, *e.g.*, in the case of sight; and I am no more able than is Dr. Heinrich to offer an explanation of their absence in the case of pure tones.

LITERATURE.

Experimental Psychology. A Manual of Laboratory Practice. Volume I, Qualitative Experiments, Part I, Student's Manual; Part II, Instructor's Manual, by EDWARD BRADFORD TITCHENER. The Macmillan Company, New York, 1901. Part I, pp. xviii+214; Part II, pp. xxxiii+456. Price \$1.60; \$2.50.

In these volumes Mr. Titchener has accomplished an extremely difficult task with extraordinary success. The interests of solid, scholarly instruction in experimental psychology have been rendered an invaluable service, and it does not seem too sanguine to predict a radical alteration in the academic status of this branch of science, as an outcome, direct or indirect, of Mr. Titchener's work. It is not implied by this statement that experimental psychology is to come to its own instanter in the matter of academic dignity and scientific repute. It will come to that just as speedily as its deserts really warrant. Nor is it intended to predict, much less to advise, a slavish adherence to Mr. Titchener's views and modes of procedure. But the lack up to this time of even approximate uniformity in laboratory instruction, and the very inadequate systematization of the elementary phases of such work, have co-operated on the one hand to detract from its disciplinary prestige, and on the other hand to leave upon the mind of the average student an altogether undesirable impression of incoherent discontinuity. The present Manuals furnish precisely the systematized focus which is needed to bring together the divergent practices of different instructors and different institutions. Whether the books are adopted outright or not in laboratory work, they offer a perfectly definite standard of comparison, which will unquestionably do away with a deal of needless misunderstanding; and their methods are so clearly superior to those in vogue in many places, that they must infallibly secure recognition. Moreover, it seems wholly impossible for a student to work conscientiously through such a course, without gaining the same kind of mental discipline, which supposedly accrues from a substantial laboratory course in other lines of science. Nor is it conceivable that he should come from such a drill without a vivid sense of the large and rapidly growing body of demonstrable facts and principles which the experimental psychology of to-day has to offer. This need not be at the expense of a just apprehension of the extensive region still open to speculation and controversial opinionating and the more alluring domains as yet wholly unexplored. But the emphasis will fall where it ought to fall with a beginner, *i. e.*, on the side of established achievement, upon which fresh achievement must be founded.

Before proceeding to examine the construction of the work in its details, it is desirable to discuss briefly the principle upon which volume I is distinguished from volume II. [Volume II is in course of preparation.] This principle involves the severance of qualitative from quantitative experimentation. How far is such a severance possible, and granting its possibility, how far is it judicious? One need not be profoundly versed in the Hegelian logic to appreciate the impossibility of any absolute separation of qualitative and quantita-

tive analyses. Nevertheless, chemistry at least has found the distinction of large practical utility and there is at the outset, therefore, some presumptive evidence from analogy in favor of the incorporation into psychological methods of this differentiation. As applied to psychology the distinction clearly involves the mere question of the specific focus of interest. Are you concerned primarily with the problem of the constitution of a mental complex and its analysis into the several component factors, then your method is essentially qualitative. You cannot in such a method disregard quantitative elements. Indeed, you must employ them as parts of your technique. But your interest is not centered upon them as the end of your inquiry. Conversely, a quantitative analysis must involve qualitative differences brought out in the course of investigation, but in this case they fall into the background as of secondary importance.

Whether in actual practice it is not economical of time and effort to work over a given field, *e. g.*, that of dermal sensations, by intermingling quantitative and qualitative experiments, rather than to follow out the complete series of qualitative observations first, is a matter which can be decided only in the light of experience and the exigencies of local conditions. Numerous considerations, both pro and con, will at once suggest themselves. But despite Mr. Titchener's obvious opinion, there seems to be no reason why, after the appearance of the Manual on quantitative work, an instructor should not combine the two in any way he chooses. It may be, that when this second volume appears, the author will assign quantitative investigations a position in the hierarchy of psychological methods, which will still further fortify the wisdom of his division.

It has been a source of the utmost gratification to the reviewer to note the author's repeated emphasis upon the fundamental importance of qualitative analyses. The present writer has long felt that the somewhat morbid ambition of many of our most energetic experimentalists to present the facts of psychology in the purely quantitative formulae of physics and mathematics was retrogressive and harmful in its influence. It is not that quantitative considerations have not an important place in experimental methods. On the contrary, this is stoutly maintained. But they must always be ultimately subservient to the interests of qualitative analyses, otherwise we have no longer psychology, the science which investigates the structure and function of mind, but mathematics—or physics—indulging herself in a new field. When a student, who is temperamentally a physicist or a mathematician, strays into psychology, it should cause no surprise to find his perspective somewhat distorted, much less to find him at times confusing means and end. But it certainly does furnish adequate ground for frequent and, if necessary, vociferous insistence on the proper position of quantitative methods.

In the general form and construction of his book Mr. Titchener has consulted the best precedents of the laboratory manuals in other sciences. The student's part contains in the case of each experiment a succinct and lucid statement of the purpose of the experiment, a list of the materials necessary, with explicit dimensions, and definite instructions for the mode of procedure and the tabulation of results. Suggestive questions at the end of the directions invite the student to emphasize the most significant portions of his observations, to connect them with that which he has previously learned, and to go on beyond the limits of the original problem to further questions of cognate character. Cuts, diagrams and illustrative tables are liberally provided.

In the older sciences the question might be raised concerning the necessity for an instructor's manual. But in the present condition of

experimental psychology the issue is hardly open and, if the contrary opinion is held, a glance at Mr. Titchener's Part II should disabuse one of the impression.

The introduction contains an excellent discussion of general methodological subjects, including a fresh pronunciamento upon Mr. Titchener's favorite topic, the structural-functional psychology question. The author's honest and enthusiastic partisanship upon this matter is considerably in evidence in both parts of the Manual. The bibliographical machinery is one of the most striking features of the volume. It represents enormous labor and exercise of the nicest judgment. So far as the reviewer feels competent to judge, the task has been executed with the utmost conscientiousness and with admirable sanity. In many particulars it is distinctly the most useful bibliography on these subjects now extant. Each chapter is opened by a brief critical exposition of the facts and principles which are to be considered. These paragraphs are extremely important, not only by virtue of their intrinsic value as clear formulations of complex situations, but also as furnishing the instructor in large measure the point of view from which the author has made his selection of experiments and ordered the procedure involved in them. The commoner forms of apparatus are described and often illustrated by cuts. Alternative forms of apparatus are compared and in many instances prices are quoted as well as makers. The directions for the individual experiments contain suggestions for the avoidance of common difficulties, and answers, or indications of the answers, to questions suggested in the student's part of the Manual. Attention is also called to different forms of many of the experiments and emphasis is laid upon such features as have been of special historical importance, whether from a controversial point of view or otherwise. The tabulated examples of typical student observations will be found extremely valuable and suggestive.

The arrangement of topics resembles closely that followed in the author's *Outline of Psychology*. Experiments upon the various forms of sensation furnish an introduction to the analysis of affection, perception, memory, etc. The instructor is advised against permitting all of his class to work upon the same topic at one time. There are certain indisputable advantages belonging to this method, but the reviewer's experience leads him to question the universal wisdom of this policy. The conditions of the curriculum in many institutions must—to mention but a single point—frequently necessitate the combining of laboratory work with somewhat detailed lecture work. Indeed, something may be said for this as intrinsically the preferable plan. In any case, where this scheme is actually in operation, it becomes almost essential to keep the members of the class upon closely related, if not identical, problems. Otherwise we involve either a waste of the instructor's time in needless repetition, or a loss of maximum attainment on the part of the student, through injudicious postponement of critical and exegetical lectures. The situation which Mr. Titchener has in mind is not exposed to this criticism, because it contemplates an extended and thorough introductory course of systematic lectures. Moreover, he explicitly calls attention to the possibility of making the experiments articulate, as closely or as loosely as one chooses, with systematic lectures and discussions. But it is certainly problematic, whether the attempt to keep the members of a class engaged upon different subjects does not carry with it as a necessary consequence the practical abandonment of general lectures paralleling the laboratory work.

In the selection of the thirty-seven experiments, which constitute the course—designed to occupy a half year—Mr. Titchener has put

his judgment and experience to the severest test. He will not look for unqualified endorsement of this part of his work from his fellow craftsmen, for it is altogether improbable that any two experimentalists would agree upon an identical series. He will have scored a notable success if he escape the charges of omitting some essential features and incorporating some ambiguous, inaccurate experimentation. Although the reviewer proposes in a moment to have his little fling at Mr. Titchener, he cannot conscientiously lay either of the above complaints at his door. Taken as a whole the experiments serve admirably to convey not only a substantial knowledge of the basal facts concerning the several processes of fundamental psychological import, but also a trustworthy impression of the scope and technique of the more significant experimental methods employed for the qualitative analysis of consciousness.

As suggestive of the variants which would commend themselves to the reviewer, the following may be mentioned. One or two experiments upon the aesthetic preferences among simple line figures might be added. These experiments are not difficult to arrange in a manner sufficiently accurate greatly to assist the analysis of elementary aesthetic processes. They can readily be made to furnish a highly valuable basis of a concrete kind for an intelligent apprehension of the aesthetic categories of symmetry, proportion, etc. In view of the constant necessity for precautions against fatigue, it seems judicious to have at least one experiment in which the progressive stages of mental fatigue are themselves the subject of observation. Certain of Binet's computation methods are readily available for this purpose and they are at least sufficiently representative to be of real value in such a course. More important, perhaps, than either of these experiments is the experiment involving the comparison of visual and tactal space. Space is so conspicuously unhomogeneous in its psychological characteristics, and our comparative judgments are so evidently developed achievements involving complex experiences, that this experiment is of great significance as a ready and conclusive mode of furnishing relatively precise impressions of certain of the sensory interrelations concerned. The extremely easy test upon the so-called size-weight illusion possesses a somewhat similar value. It is of course understood that, alongside of considerations of intrinsic value, one has in selecting one's experiments to take account of available time. The above suggestions may serve to illustrate, however, the comment made a few lines above, that every laboratory man would have his own pets, which he would in some cases possibly prefer to Mr. Titchener's recommendations.

The one point where the reviewer feels disposed to take serious issue with Mr. Titchener concerns his treatment of the physiological expressions of the affective processes. This is an issue of fact and Mr. Titchener undoubtedly is convinced of the reliability of his observations. Certainly he couches his directions and specifications so that—to mention only a single instance—one must gather that one has made a faulty experiment, if one fails to secure dilatation of the blood vessels of the hand and arm, when supposedly experiencing pleasure. On this subject the reviewer is undoubtedly partisan and therefore a critic open to just suspicion. But he feels that the body of evidence presented in recent years by the laboratories of the Sorbonne and the University of Chicago, without mentioning many other trustworthy observations, is sufficient to warrant a more conservative attitude than the one adopted. In the case of the theories of reaction, for example, Mr. Titchener, who has in this field been a vigorous protagonist, makes a presentation which is altogether unprejudicial to the interests of the

different views maintained by experimentalists. In the present case of the affective processes our criticism does not touch his right of adherence to the older doctrine, but rather the mode of presentation, which in our opinion is distinctly indicative of finality, where finality is quite open to question. With Mr. Titchener's view of the relation of affection to attention and the conspicuous place which attention occupies in the experimentation above referred to, the nexus between the older and the newer formulations is by no means difficult to establish. We regret, therefore, that the author has not phrased this part of his work more flexibly. In a similar manner the reviewer is quite confident that the statements based on the dynamometrical experiments are too extreme. A full discussion of these points is, however, obviously out of place here.

Despite the conventional unpopularity of comparison, Mr. Titchener's book will inevitably be compared with Mr. Sanford's *Manual*, which has hitherto occupied the field alone. A word of comment on the two books may, therefore, be permitted. In the reviewer's opinion the books so far from becoming competitors are likely to be felt as indispensable supplements to one another. There can be no possible question that Mr. Titchener's volumes supply a long felt need, which Mr. Sanford's book largely failed to satisfy. We have already pointed out some of these particulars. But Mr. Sanford's book has been of invaluable assistance to every laboratory in this country, and its wealth of experiments and its convenient bibliographical materials will retain for it a necessary place in every laboratory course. With two such books at his side it must be an ill-trained and incompetent instructor who cannot make his introductory experimental work effective and interesting.

Mr. Titchener's publishers have given his books a most attractive dress. The typographical work is beyond criticism. Carefully prepared indices, lists of apparatus, etc., complete the highly efficient system of devices for rendering the material of the volumes easily accessible.

The University of Chicago.

JAMES ROWLAND ANGELL.

The origins of Art—a psychological and sociological inquiry, by YRJO HIRN. Macmillan & Co., 1900.

In this carefully written volume of 300 pages Prof. Hirn has given us, not only an able discussion of most of the current questions of æsthetic theory, but has so balanced certain features of explanation that the result becomes original if not completely just. Art is represented as arising from a feeling-state or emotion, in which is contained the desire not only for exteriorization but for social transmission. In this latter process secondary qualities arise which aid in securing the transmission and perpetuation of the original feeling-state. These have been derived from the media, which, moreover, were originally called into being by utilitarian non-æsthetic needs. These media are not merely to be regarded as the material, the clay, the gesture, the mark, the sound, the bright or attractive object, but the purposes already in existence before the art-impulse uses them for its higher needs. These are also origins, among which Prof. Hirn discusses in detail (1) the need for conveying information, which in an art form is retained as lucidity; (2) the need for erotic propitiation, or more generally for obtaining favor, recognized in the sensuous and attractive forms of art; (3) the need of co-ordination in work or war, retained as stimulation or excitement; and (4) the faith in magic, giving us the most characteristic quality of imagination.

As will be seen, this is a scheme which fits in most admirably to the

exigencies of research. These four sub-heads really classify different explanations that have been offered of art phenomena, and thus form excellent divisions by which the literature of the subject may be conveniently treated. The book bears the imprint of the serious scholar not only in its immediate contents but in the very complete references and indices which are appended.

It is to be regretted, however, that a writer so subtle and discriminating as Prof. Hirn has seemingly never deliberately placed before him the chief aim of the modern psychologist in all matters of origin. This we might say is not so much to analyze correctly the conscious processes, introspectively, experimentally or anthropologically, and to assume the beginning of these processes as to any extent original; but, taking such an analysis as a starting-point, both to enquire what light it throws upon processes, no doubt partially represented although not consciously related, and to discover how these partially represented processes affect the analytic starting point. Consciousness thus becomes something like a tool with which we essay to unearth the buried tree of phylogenetic mental life, a tool, however, made from this very tree itself.

Retaining a firm hold upon this genetic point of view, we may readily admit, with Prof. Hirn, that the already evolved or present art impulse may use and transpose purposes of magic, purposes of erotic propitiation, etc., without denying that possibly one or other of these motives, or rather what lies back of them, may not have created the art-impulse itself. To illustrate by an analogy the mud wasp does not build its cell, fill it with spiders alive but numb, and lay its eggs for any conscious reproductive purpose, but it is yet the reproductive instinct which leads to, and creates, or is the deepest origin of the acts in question. The appeal to consciousness, although in one sense ultimate, must be interpreted much more broadly and genetically than is apparent in the book before us. When one looks for ultimate origin he looks for something deeper than individual or social purpose.

In the view of the present writer, Prof. Hirn is never stronger than at the start. All the facts of recent research converge to render unsailable his claim against the intellectualist and in favor of the emotionalistic interpretation of art. But in showing what is contained in the art feeling-state or emotion, Prof. Hirn unfortunately deserts his original position and continually offers conscious intellectual purposes as the essential content of his explanations. This is shown in his first step introducing the social factor where he makes it an essential feature of the art-impulse that it should convey the feeling-state to others. To convey not only art feelings but every kind of feeling and thought to others is no doubt essential to normal human beings, but there is no proof that this decidedly not autotelological purpose makes any particular art production either more or less artistic. When an artist consciously tries to shape his product so that it may be acceptable to others he may as frequently be destroying its real artistic quality as not. In the same way it is no doubt true that the art impulse tends to enhance or relieve an emotional state, and Prof. Hirn is particularly excellent in his analysis of these effects, but there is no proof that this conscious purpose is to be looked upon as their origin, or indeed as always favoring their manifestations.

An illustration will make this plainer and also bring to light a feature of the art psychosis neglected by Prof. Hirn. Pres. G. Stanley Hall in his study on Children's Fears gives the case of little girl who on going to bed imagined the room tenanted by crawling shapes of every kind. After enduring this for many nights she came to imagine the four big lions stalked into the room and took up their positions as

defenders at the four corners of the bed. At this point the little girl fell peacefully asleep.

These few events have all the essentials of a little drama, but without desire to communicate it to others, nor was there any conscious purpose to relieve the state of mind. The conscious efforts had no doubt been already tried and found ineffectual, and that partly because they were conscious or known to be intended. It is only when the lions stalk in of themselves that the imagery becomes a drama or a real art product.

It is this completion of a train of feeling with its images in such a way as to become satisfactory but without depending on outside help, that is the essential feature of the art psychosis neglected by Prof. Hirn, and which accounts not only for such stories as Red Riding Hood, but modern novels where the authors report that these characters seem to them to have a life of their own which they feel forced to obey and follow in their delineations. This is manifest in music and dancing, but also in the graphic forms where, for example, as in painting, the picture as it becomes artistic and not a mere photograph, asserts itself as the meaning of the objects portrayed, which latter are changed, augmented, decreased, selected or emphasized, so that the picture recalls nature, but also completes or adds to it, much in the same way as the lions and their emotional accompaniments, stalked into the scene of the little girl and made it a satisfactory play.

With this difference in the analysis of the essential feature of the art psychosis it is easier to see the possibility of the completed Art state or emotion being derived from a deeper lying emotion or state which has so combined with the other contents as to transform or complete them. In the case of the little girl, it was a sthenic emotion of some kind which came in, accompanied by, either slightly before or slightly after, the entry of the lions. The question for the psychologist is, what is the original phylogenetic form of this sthenic emotion? That it was an emotion not so much of self-confidence, but of love and reliance on another, with a characteristically feminine sense of protection is an indication. All the better for the phylogenetic interpretation that it occurs in a case, where any conscious sexual purpose or feeling must be absent. Indeed Prof. Hirn's assumption that the phrase "erotic propitiation" describes the theory of the sexual origin of art, rather than narrows it, and perhaps degrades it, is of itself sufficient to blind him to the real value of the theory, for further appreciation of which the reader may be referred to the present writer's article in Vol VII of this *Journal*.

COLIN A. SCOTT.

Sovremennaja experimentalnaja psychologija w jej otnoshenii k woprossam schkolnago obuchenija. [Modern experimental psychology in relation to questions of school instruction.] By ALEXANDER NETSCHAJEFF. St. Petersburg, 1901. pp. 236, with 79 tables.

The species of psychological pessimism "made in Germany," which Münsterberg has been endeavoring with so much ardor to introduce into America, has apparently not infected Russia. Dr. Netschajeff's book is a strong earnest plea for the application of experimental psychology to education and a refutation of the dogma that this new science is not of direct value to the teacher. He admits that the teacher need not necessarily be an experimenter herself; but that she must be familiar with the results of experimental psychology; and he believes that these results are easiest comprehended when one knows the methods and steps by which they have been reached.

The first chapter discusses the adaptation of the school programme to age and mental capacities of children. The author cites from Gilbert's studies made at New Haven facts which tell strongly against

rigid uniformity. The second chapter discusses the school day with special reference to the effects of mental fatigue. He very clearly shows that the best intellectual work can be done only when frequent rest pauses are taken. Recesses must therefore be provided with sufficient frequency to afford opportunities for recuperation. In no sense can gymnastics take the place of the free spontaneous exercises which the recess affords. Indeed, the author is very pronounced in his opposition to gymnastics—at least as required in the Russian schools. They are stiff and mechanical and military, he affirms, and are heartily hated by the children. In the third chapter he discusses some of the factors involved in healthy mental development. With young children objective methods are strongly commended. The fourth and fifth chapters discuss various problems of school instruction—means of training the memory, uses of oral reading, acquisition of skill in mechanical exercises, etc.

The style of the book is clear and simple as it is intended for the use of Russian teachers. All the author's statements are well supported with facts from experimental psychology, and his familiarity with a wide range of investigations made in Germany, France, and America is quite remarkable. One finds frequent citations in his book of the excellent investigations made at Clark University, Yale University and other seats of learning in the United States where the value of psychology for teachers is illustrated and emphasized.

WILL S. MONROE.

BOOK NOTES.

Gustav Theodor Fechner, von WILHELM WUNDT. Wilhelm Engelmann, Leipzig, 1901. pp. 92.

Wundt here sums up in an admirable and comprehensive way Fechner's views upon nearly all of the chief topics to which his life was devoted, viz., personality, the night view of things, the problems of life, consciousness, God, the psycho-physic scale of the world and of immortality, the day view, the Zend-Avesta. In the supplement of thirty pages, personal memories are related. His relation to the philosophy of our time and spiritualism are summed up, and his own method is characterized. In the appendix a list of his works is given.

Histoire et Solution des Problèmes Métaphysiques, par CHARLES RE-NOUVIER. F. Alcan, Paris, 1901. pp. 477.

This work is a development of that part of the author's dilemmas of pure metaphysics in which he condensed the chief theses involved in sustained thought. He deals with the ancient world, the systems of Plato, Aristotle, and their successors, Neo-platonic Christianity, theological pantheism, synthetic and critical philosophy, materialism and atheism, and the present state of philosophy in France.

L'Année Philosophique. (F. PILLON.) Vol. XI, 1900. F. Alcan, Paris, 1901. pp. 316.

The first 131 pages are devoted to four essays; one by Brochard on myths in the philosophy of Plato, by Hamelin on the origins of Spinozism, one by Dauriac on the categories, and one by Pillon a critique of Bayle and of Cartesian spiritualism.

Études de Psychologie, par J. J. VAN BIERVLIET. F. Alcan, Paris, 1901. pp. 201.

We have here four essays, the longest on right and left handedness and the asymmetry of the nervous system and of functions, followed by briefer essays on visual illusions, illusions of weight, and on the relations between circulation and cerebration.

On the Psychology and Physiology of Reading, by EDMUND B. HUEY. (Thesis.) Reprinted from the *American Journal of Psychology*, Vols. XI and XII. pp. 22.

These studies deserve more than passing notice, for they mark an important technical step in advance in our methods of studying the act of reading. Most interesting, perhaps, is the discovery that the eye does not move steadily along the line, but goes by hitches and starts.

Les Timides et la Timidité, par PAUL HARTENBERG. F. Alcan, Paris, 1901. pp. 264.

These data are based upon self observation, questionnaires, direct questions, experiments and bibliographies. The themes discussed are definitions, attacks of timidity, traits of the timid, evolution, cause and varieties of fear, morbid fears, prophylaxis and therapeutics.

Hypnotism and Suggestion in Therapeutics, Education, and Reform,
by R. OSGOOD MASON. Henry Holt and Co., New York, 1901.
pp. 344.

The chapters here are the subjective element in the newer therapeutics, the relation of hypnotism to the subconscious mind, cases in general practice treated by hypnotism and suggestion, educational uses of hypnotism, forms of suggestion useful in the treatment of inebriety, six cases treated by hypnotism without suggestion, and the ethics of hypnotism.

Mental Wandering, by WILLIAM JULIUS MICKLE. *Brain*, Part 1,
1901. pp. 26.

The distinctive features of this paper deal with partial or complete transient division of self consciousness in mild, quiet delirium, attempts to analyze phantasmal experiences; the metamorphosing effects of sleep dream; and the lively emotion of play in mental wandering.

Studien über die Narkose zugleich ein Beitrag zur allgemeinen Pharmakologie, von E. OVERTON. Gustav Fischer, Jena, 1901.
pp. 195.

After a general part characterizing anaesthetics and the various methods, the writer discusses the chief hypotheses on the mechanics of narcosis. In the special part, which follows, the narcosis of ether and chloroform are treated in great detail.

Les grands Symptômes Neurasthéniques (Pathogénie et Traitement),
par MAURICE DE FLEURY. F. Alcan, Paris, 1901. pp. 412.

The sensation of fatigue, the condition of the circulatory apparatus in neurasthenics, troubles with sleep, digestion, excretion, the genital system and the mind, are the captions under which the writer gives us an interesting and comprehensive survey with suggestive tables and charts.

L'Opinion et la Foule, par G. TARDE. F. Alcan, Paris, 1901. pp. 226.

The relations of the crowd to opinion and the way in which they influence it are here made the subject of a very interesting memoir. The data are gathered not only from normal, but from criminal groups, and we have here interesting contributions also the psychology of conversation.

Eaglehawk and Crow. A Study of the Australian Aborigines, by
JOHN MATHREW. New Amsterdam Book Co., New York, 1900. pp.
288.

The writer's novel views upon the anthropology of Australia are essentially that the language of the extinct Tasmanians was the substratum of the Australian languages; that they were the first occupants of the country; that it was settled not from the northwest, as Eyer had urged, but from the northeast; that the amalgamation of the two races offered an explanation of the existence of two primary exogamous classes through the greater part of Australia. The work is largely linguistic and abounds in tables and vocabularies.

Races and Peoples. Lectures on the Science of Ethnography, by DANIEL
G. BRINTON. David McKay, Philadelphia, 1901. pp. 313.

The physical elements of ethnography; the psychical elements of ethnography; the beginnings and subdivisions of races; the Eurafri-
can race, including the Hamitic, Semitic, Euskaric, Aryac and Cau-
casian stocks, are treated in the first five lectures. Then follow the
Austafrican, including the Negrillos, Negroes and Negroids; and

finally the Asian race with its two branches of Sinitic and Sibirie. The three concluding lectures are on insular and littoral peoples, including Negritic, Malayic and Australic; the American race; and problems and predictions, including the ethnographic problems and the destiny of races.

The First Interpreters of Jesus, by GEORGE HOLLEY GILBERT. The Macmillan Co., New York, 1901. pp. 429.

The first interpreters of Jesus are still first in influence and authority. The writer fears this has not been sufficiently recognized. The question is just what do these writers teach; what is central and what subordinate in each; what is their point of view and what did they seek to impress upon their readers? In this spirit the author considers the teachings of Paul, those of the minor writers, and those of John, in the three parts of his book.

Das Leben Jesu bei Paulus, von RICHARD DRESCHER. J. Ricker, Giessen, 1900. pp. 65.

The author discusses the Pauline conception of Jesus in each of his leading epistles.

Die Bildersprache Jesu in ihrer Bedeutung für die Erforschung seines inneren Lebens, von HEINRICH WEINEL. J. Ricker, Giessen, 1900. pp. 49.

The writer takes his point of departure from Jülicher and attempts a "hermeneutics psychologically oriented." The endeavor is to find the psychic experience that is presented in or lurks behind each of the analogies.

Die Anfänge unserer Religion, von PAUL WERNLE. J. C. B. Mohr, Tübingen, 1901. pp. 410.

Under the section on the origin of religion the writer discusses the calling and prophecy of Jesus, the primitive Christian community, the church, the earliest theology, Paul, Jesus among the heathen, the theory of redemption, the anti-Judaic apologetics, the Pauline gnosis, the apocalypse. The other section, on the development of the church, describes the decay of prophecy and the apostolate, the origin of the episcopate, the ascetics, saints and martyrs, the further development of theology, relations to Greek thought, and piety in the post-apostolic age.

Die philosophischen Grundlagen der Theologie Richard Rothe's, von WALTHER FLADE. August Hoffmann, Leipzig-Reudnitz, 1900. pp. 148.

This is an inaugural dissertation which treats its subject under the captions of the analysis of consciousness,—animal and human, self determination as a psychic and ethical idea, relations to the external world, transition to ethics in the narrow sense and the idea of its processes, ideality and reality, philosophy and theology, religion and morals.

Christentum und Darwinismus in ihrer Versöhnung, von HERMANN FRANKE. Alexander Duncker, Berlin, 1901. pp. 128.

The writer discusses the battle for a coherent view of the world, the essence of Christianity, of evolutionism, the relation of the latter to the Christian doctrine of salvation, primitive religion, Hebraism, Christianity, development and revelation, Christian morals and evolution.

Kant contra Haeckel, von ERICH ADICKES. Reuther und Reichard, Berlin, 1901. pp. 129.

The thesis here is that Haeckel's view of the world is not monism, but materialism. The latter is refuted. True monism is described as at once probable, yet incredible. The conceptions of a world riddle is described as one of the signs of our times.

Ideen zur Philosophie der Geschichte der Philosophie, von MORITZ v. STRASZEWSKI. Wilhelm Braumüller, Wien, 1900. pp. 50.

The writer praises as the three chief ends of philosophy the deepening of the religious life, the unitary presentation of the spiritual content of our time, and the distinction between the appearances and the facts of knowledge.

The Philosophy of History, by S. S. HEBBERD. Published by the Author, La Crosse, Wis., 1901. pp. 311.

The chapters here are the nature of thought, the civilization of India, classical and mediæval civilization, the reformation and the genesis of science, modern art and morality, social revolutions since the reformation. The author's studies have been careful and extensive, and his work is an admirable and original treatment, which merits a far better dress.

The Life of the Bee, by MAURICE MAETERLINCK. Translated by Alfred Sutro. Dodd, Mead and Co., New York, 1901. pp. 427.

This is an admirably told story of the swarm, the young queen, the nuptial flight, the massacre of the males, the progress of the race, etc. The writer has carefully utilized the standard authorities.

The Limits of Evolution and Other Essays Illustrating the Metaphysical Theory of Personal Idealism, by G. H. HOWISON. The Macmillan Co., New York, 1901. pp. 396.

The most remarkable thing about this able and remarkable book is its attempt to vindicate the standpoint that all existence is either the existence of minds or that of the items and order of their experiences; that time and space owe their entire existence to the relations of minds, the co-existence of which is not temporal or spatial. These many minds may by an ancient metaphor be called the city of God. God is their fulfilled type, the bond of their union, reigning in them by light, reason and final causation. These minds are members of an eternal republic with no origin but a purely logical one and free of and controlling the natural world. They constitute the whole world of spirits, including God, united through recognition of him; and thus they are the real prime mover toward the goal of a common ideal, now called evolution. As the mind's creation simply means the eternal fact that God is a complete moral agent, and such dependence on him that if he did not exist they would not, because raised to reality in and through his existence.

This new monadology with its able and ingenuous supplements is most opportune in this day when epistemology has resolved the soul into an accidental drifting together of essentially unconnected psychic states. It will strike many as a hazardous step, but it is certain no more so than the desperateness of the situation justified. To have thus turned the instinctive longing for immortality, which is a passion with many minds as it was with the late F. W. H. Meyer toward such an hypothesis, though it be but as a protest to the morselizationists, is not only a clever strategic move, if one wished to regard it from a merely controversial standpoint, but Professor Howison's hypothesis is in the line of most of the earlier psychological thinking of the

world, and squares with one of man's deepest instincts. Demonstrable it is not any more than is the post-mortem existence of souls after death as assumed by the telepathists, but its argumentation is far above and has nothing to do with theirs.

The Lesson of the Life of Huxley, by WILLIAM K. BROOKS. From the Smithsonian Report for 1900, pp. 701-711. Govt. Print, Washington, 1901.

These few pages are perhaps the most interesting and suggestive that have been or even could be written on its subject by our leading American biological thinker, who can appreciate and judge not only the technical but the philosophical work of Huxley.

Dragons of the Air, by H. G. SEELEY. D. Appleton and Co., New York, 1901. pp. 239.

This account of extinct flying reptiles, with 80 illustrations, is by a thorough master of his subject, who has worked it over in lectures at the Royal Institution.

Outlines of general Biology, by CHARLES W. HARGITT. C. W. Bardeen, Syracuse, N. Y., 1901. pp. 164.

After ten years experiment with this new departure from the old verification methods, this work takes up the frog and fern, and then considers the animal and vegetable cell, and selects as types the hydra, medusa, fungi, earthworm, starfish, sea urchin, clam, crayfish, grasshopper, liverwort, moss and flowering plant.

Aether und Wille oder Haeckel und Schopenhauer, von RICHARD WAGNER. Hermann Seemann Nachfolger, Leipzig, 1901. pp. 238.

We have here eleven somewhat rambling but not uninteresting discussions of Haeckel, Schopenhauer, cause, space, time, genius, etc. On the whole it is an interesting, but not very luminous or novel volume.

Energismus, von JOSEF SCHLESINGER. Karl Siegismund, Berlin, 1901. pp. 554.

This is the doctrine of the absolute resting but substantial existence of the general space of worlds and its effective and creative power in an attempt to build up an anti-materialistic natural science. The author is a Professor in the Agricultural School at Jena, and develops his views in forty discourses.

The Octocyst of Decapod Crustacea: Its Structure, Development, and Functions, by C. W. PRENTISS. From the Bull. of the Mus. of Comp. Zoölogy, Vol. XXXVI, No. 7. Cambridge, Mass., 1901. pp. 251, with 10 plates.

Revision of the Skunks of the Genus Chincha, by ARTHUR H. HOWELL. North American Fauna, Aug., 1901, No. 20. Govt. Print, Washington, 1901. pp. 47, with plates.

The Commonwealth of Cells. Some Popular Essays on Human Physiology, by H. G. F. SPURRELL. Baillière, Tindall and Cox, London, 1901. pp. 115.

This booklet describes living matter, the chemistry of the body, its mechanics and physics, the nervous system, and the body generally, in five popular essays with two or three score of rough illustrations.

The Protozoa, by GARY N. CALKINS. The Macmillan Co., New York, 1901. pp. 347.

This is a summary adapted to the needs of both general and special

students of biology. Its subject matter is treated from the historical, comparative, and general point of view. Its index and bibliography, the latter of which is up to date, greatly increase its value.

Dictionary of Philosophy and Psychology, edited by James Mark Baldwin. Vol. I, pp. 644. The Macmillan Co., New York, 1901.

This is the first volume of a long expected, needed, and comprehensive work. It includes many of the principal conceptions of ethics, logic, æsthetics, philosophy of religion, mental pathology, anthropology, biology, neurology, physiology, economics, political and social philosophy, philology, physical science, and education, and gives a terminology in English, French, German and Italian. We withhold final review until the appearance of the other two volumes. Suffice it to say here, that it promises to be a work entirely indispensable to every pupil and student of the subject.

A Manual of Psychology, by G. F. STOUT. Hinds and Noble, New York, 1899. pp. 643.

This work claims to be from a genetic point of view and illustrates the earlier stages by reference to the mental life of animals and the conditions of lower races; but it should be distinctly said that it is essentially the stock subject matter of psychology, and is genetic in hardly any sense except that it places sensation first, and passes on to perception, conception, etc.

New Psychology, by J. P. GORDY. Hinds and Noble, New York, 1900. pp. 402. Price, \$1.00.

This primer, which has now reached its seventh edition, recognizes the newer departments of child study, brain and nerve, Herbartian interest and apperception, and is designed for progressive young teachers, who have not been to college. Questions are appended to all its brief forty-two chapters.

Die Element der Psychologie, von H. DE RAAF. H. Beyer und Söhne, Langensalza, 1901. pp. 132.

The formation of concepts, their movement, thinking and understanding, logical, æsthetic, moral, and religious consciousness, and finally self-consciousness, are the subjects treated.

Contributions to a Psychological Theory of Music, by MAX MEYER, University of Missouri Studies, June, 1901, Vol. I, pp. 80. Price, 75 cents.

Professor Meyer, formerly Wundt's assistant, is one of the best living authorities on the psychology of music from the physicist's standpoint. He is certainly now our American authority, and his years of careful experimentation, first at Clark and for a year in Missouri, have distinctly enlarged our knowledge of this subject and resulted in important corrections of the views of Helmholtz and other previous writers. In this valuable paper, Dr. Meyer first discusses the æsthetic laws of melody, containing only two different notes, and then the complete musical scale. This is followed by an analysis of thirteen complex melodies; *i. e.*, of melodies not related directly to each other, so that it must be theoretically dissolved into partial melodies. Most interesting are the fourth, fifth and sixth chapters on the psychological laws effective in the historical development of melody; on the theory of melody; and the æsthetic laws of harmony.

Studies from the Yale Psychological Laboratory, edited by Edward W. Scripture. Vol. VIII, 1900. Yale University, New Haven, Conn. pp. 123.

This eighth volume contains a safe test for color vision by the editor; researches on movements used in writing; a second series of cross-education studies; and a computation of a set of simple direct movements.

Laboratoire de Physiologie de l'Université de Turin. Travaux des Années 1899-1900 publiés sous la direction de A. Mosso. Hermann Loescher, Turin, 1901. pp. 222.

The most important studies here are blood pressure; uterine temperature; the transplantation of testicles; the law of voluntary muscle work; the function of tactile corpuscles; the oscillation of tactile sensations produced by stimulus.

La Psychophysique, par MARCEL FOUCAULT. F. Alcan, Paris, 1901. pp. 491.

The first part characterizes Fechner and his predecessors; the second is entitled evolution and criticism of psycho-physics and describes the work of Helmholtz, Plateau, Delboeuf, Hering, Breton, Charpentier, G. E. and F. C. Müller, Titchener, Orchansky, Ebbinghaus, Boas, Stumpf, Henri and others.

Vision, by W. H. R. RIVERS. Appendix by C. G. Seligmann. Reports of the Cambridge Anthropological Expedition to the Torres Straits. University Press, Cambridge, 1901. pp. 140.

This paper of 132 quarto pages is devoted to a report of a very careful study of the visual power of the natives as to acuity, color, and spatial perception.

Imitation or the Mimetic Force in Nature and Human Nature, by RICHARD STEEL. Simpkin, Marshall, Hamilton, Kent & Co., Ltd., London, 1900. pp. 197.

Imitation is considered in successive chapters in economics, psychology, ethics, religion, politics, law, custom and fashion, language, poetry, fine art, habit and instinct, heredity, in molecular forces, series and in reasoning.

La psiche nei fenomeni della vita, di G. SERGI. F. Bocca, Torino, 1901. pp. 221.

The writer seeks to sum up here in fourteen chapters the recent studies of psychic phenomena in the lowest forms of life. His chief themes are—vital movement and energy in uni- and plura-cellular organisms; excitability in living substance; sensibility as a biological property; the idea of movement; consciousness as a psychic character; the conscious direction of movements; instincts; psychological heredity; mnemonic reproduction; psychological interpretation; soul and life.

Memory. An Inductive Study, by FREDERICK W. COLEGROVE. Henry Holt and Co., New York, 1901. pp. 369.

This is a second revised edition, with an introduction by President G. Stanley Hall, and it is a volume that is sure of a place in the library of every psychologist, and is worthy the careful perusal of every teacher.

Proceedings of the Society for Psychical Research. Oct., 1901, Vol. XVI, Part XLI. Kegan Paul, Trench, Trübner and Co., London, 1901. pp. 649.

Here at last we have Professor J. H. Hyslop's study with Mrs. Piper of the problem of personal identity. The author throws out the question of the supernormal and of spiritualism generally. Spiritism as an alternative explanation to telepathy, we are told, is nothing more than the question whether the brain of the medium is adequate to account for the facts. During his entire work Professor Hyslop has not remarked "one single suspicious circumstance." The last half of the volume is an appendix of four sittings, with notes. We hope to give a fuller review of this study later.

The Practical Secrets of the New Psychology and Mind vs. Medicine in the Treatment of Disease, by J. SAM JONES. Harrison, Ark. pp. 136.

These precious pages of this little \$5 pamphlet must not be measured solely by the value of their scientific message to a world lying in ignorance of soul secrets, but also by their power, when rightly applied, to treat, if not cure, all diseases. Appendicitis, bashfulness, corns, business success, control of children, deafness, fits, freckles, "la grippe," love making, nervousness, paralysis, pimples, piles, stammering, sleeplessness, the tobacco habit, whiskey habit, warts, etc., may all be affected, if not cured, by the new psychology here taught.

Studies on the Effects of Electricity on Organisms. II. The Reactions of Hydra to the Constant Current, by RAYMOND PEARL. Reprinted from the Amer. Jour. of Physiology, Vol. V, June, 1901, pp. 301-320.

Der Ursprung der Sprache, von F. LÜTGENAU. Hermann Seemann, Leipzig, 1901. pp. 32.

Experimentell-Psychologische Untersuchungen über das Urteil, von K. MARBE. W. Engelmann, Leipzig, 1901. pp. 103.

De l'influence de l'esprit sur le corps, par DR. DUBOIS. Schmid and Francke, Berne, 1901. pp. 92.

Ueber Sinneswahrnehmungen und Sinnestäuschungen, von DR. KORN. Vogel und Kreienbrink, Leipzig, 1901. pp. 29.

A Text-book of Medicine for Students and Practitioners, by ADOLF STRÜMPPELL. D. Appleton and Co., New York, 1901. pp. 1242.

This magnificent work, now in its third American and thirteenth German edition, and with 185 illustrations, is a well known standard work, which has been now almost wholly rewritten. It thus retains all the merits of the earlier production, while it has the advantage of being most nearly in line with recent investigations. It should have a place in the library of every physician. Its indexes and convenient arrangement of subject matter make everything accessible.

Textura del sistema nervioso del hombre y de los vertebrados, par S. RAMÓN CAJAL. Vol. I, pp. 566; Vol. II, pp. 224. Nicholás Moya, Madrid, 1899-1900.

At last we have a summary by the author of his neurological studies illustrated by 313 cuts, all of which I believe are entirely original. Fuller review will be given upon appearance of last half of volume.

Atlas of the Nervous System, including an Epitome of the Anatomy, Pathology, and Treatment, by CHRISTFRIED JAKOB. Edited by Edward D. Fisher. W. B. Saunders and Co., Philadelphia, 1901. pp. 218, with 112 colored lithographic figures and 139 other illustrations.

This is largely a volume of brain maps, many of which are colored, and are in some respects better than anything that have preceded them. The explanatory text is both anatomical and pathological, with a description of the diseases of the nervous system. On the whole this book easily ranks as the most important of all manuals on the subject. Its plates are models of clearness, and the author has wisely confined himself in every case to the size of the book, so that there is no folding or unfolding. If any criticism were to be made, it might be that some of the many colored plates are a little too intensely stained and that the schematic drawings are a trifle more definite than facts warrant.

Nervous and Mental Diseases, by ARCHIBALD CHURCH and FREDERICK PETERSON. W. B. Saunders and Co., Philadelphia, 1901. pp. 869.

This third edition, with its 322 illustrations, has been thoroughly revised both by editions and rearrangements wherever necessary to make it more acceptable to students and practitioners. Some sections have been entirely rewritten and new diagrams and tables added. While it is essentially a practitioner's book, it is also a careful and judicious treatment from a scientific point of view, and the authors have also evidently drawn to a considerable extent upon their own experiences.

Studien über die Narkose zugleich ein Beitrag zur allgemeinen Pharmakologie, von E. OVERTON. Gustav Fischer, Jena, 1901. pp. 195.

After a critical discussion of the chief hypotheses on the mechanism of narcosis, the writer discusses in detail the effects of ether and chloroform and the results of his experiments with single groups of organic narcotics, including those with aromatic combinations, and finally inorganic anæsthetics with some remarks on the mode of action of basic narcotics and their combinations.

Die Periodischen Geistesstörungen, von ALEXANDER PILCZ. Gustav Fischer, Jena, 1901. pp. 210.

Circular insanity, periodic mania, melancholia, amentia, paranoia, dipsomania, sexual abnormalities, secondary periodic psychoses, somatic accompaniments and results of post-mortem examinations, and the combinations of periodic with other kinds of insanity, are the topics considered.

Psychologie de l'Idiot et de l'Imbécile, par PAUL SOLLIER. F. Alcan, Paris, 1901. pp. 236.

This is a second enlarged edition, with twelve infolded plates at the end.

Les Maladies de l'Orientation et de l'Équilibre, par J. GRASSET. F. Alcan, Paris, 1901. pp. 291.

This volume contains many interesting personal observations of malorientation in those suffering from nervous and mental diseases. The nerve tracts and centers involved are discussed, also the ailments and their symptoms where this trouble is found. It is a comprehensive and valuable memoir.

Die psychologische Denkrichtung in der Heilkunde, von OTTO BIN-SWANGER. Deutsche Rundschau, Oct., 1900. pp. 87-103. Julius Rodenberg, Berlin.

Psychology and the Medical School, by GEORGE V. N. DEARBORN. Reprinted from science, N. S., Vol. XIV, July 26, 1901. pp. 129-136. *Journal of Medical Research*, edited by Harold C. Ernst. N. S., Vol. I, No. 1, July, 1901. Boston.

The Works of George Berkeley, including his Posthumous Works. With prefaces, annotations, appendices, and an account of his life, by AL-EXANDER CAMPBELL FRASER. In four volumes. pp. 527, 415, 412, 611. Clarendon Press, Oxford, 1901.

In 1899 Professor Fraser was asked by the delegates of the Oxford Press to preface a new edition of Berkeley's works with some account of his life, as the edition of 1871 was out of print. Although in his eighty-second year, having been for more than sixty years a lover of Berkeley, he undertook, and has now completed this work, utilizing all the valuable biographical and philosophical material, and also the invaluable manuscript of Archdeacon Rose. In this edition, the introduction and notes have also been almost entirely rewritten, although this is not intended to supersede the author's life of Berkeley. Much of the new material came in too late to permit of purely chronological arrangement which has, however, been mainly adhered to. On the whole, these volumes are attractive and convenient in form, and will be indispensable to all teachers of philosophy who have no earlier edition, and highly desirable for those who have.

Malebranche, par HENRI JOLY. F. Alcan, Paris, 1901. pp. 296.

The views of this great Cartesian, whom some think Berkeley's interviewer with him killed, are here presented in their unity. The many quotations are well chosen, and they attractively present the incomprehensibility of God, the soul, and the ideals of perfection.

Pour la Raison Pure, by F. EVELLIN. F. Alcan, Paris, 1901. pp. 34.

This is an attempt to summarize the many conflicts between imagination and reason.

Philosophie des Sichselbstbewussten, von FRIED. WILHELM DAHLMANN. Koelling und Klappnenbach, Chicago, 1901. pp. 146.

This book with its fine German type, to our thinking, remarkably tasteless get up, its long paragraphs and sentences, with neither index or table of contents throughout, may have a very important message, and it may find somewhere a reader, both of which we sincerely hope.

La Philosophie Russe Contemporaine, par OSSIP-LOURIE. F. Alcan, Paris, 1901. pp. 278.

The first part describes philosophies and the general philosophy of Russia; the second is devoted to psychology; and the third to eleven sociologists, with a summary chapter urging the necessity of breaking away from isolation in Russia.

Geschichte der Philosophie im Islam, von T. J. DE BOER. E. Hauff, Stuttgart, 1901. pp. 191.

The geography of Islam is first treated; then oriental wisdom; Greek science; the views of Arabian philosophers on philology, duty, faith; the degree in which they were influenced by Pythagoras, Aristotle, Neoplatonism, which affected different Mahomedan thinkers in very different ways; and finally Arabian philosophy in the West.

Science and Medieval Thought, by THOMAS C. ALLBUTT. C. J. Clay and Sons, London, 1901. pp. 116.

This is the Harveian Oration delivered before the Royal College of Physicians, October, 1900.

A History of Philosophy, with Especial Reference to the Formation and Development of Its Problems and Conceptions, by W. Windelband. Translated by James H. Tufts. The Macmillan Co., New York, 1901. pp. 726.

The translator has in this edition incorporated all the changes made by the author in the second German edition, whether in the text or the appendix. A seven page note on certain aspects of recent English thought has also been added.

L'Évolutionnisme en Morale, par JEAN HALLEUX. F. Alcan, Paris, 1901. pp. 228.

The first part discusses the principles of moral evolution and conduct from the physical, biological, psychological and sociological viewpoint. The second part is the discussion of the hypothesis fundamental to the system and of the principles of conduct as deduced from it, with final application to practical life.

Das sittliche Leben, von HERMAN SCHWARZ. Reuther und Reichard, Berlin, 1901. pp. 417.

This is an ethics on a psychological basis with an appendix on Nietzsche's Zarathustra doctrine. The first part characterizes the ethics of personal worth or the doctrine of modern self-affirmation; the second is entitled alien morals or the doctrine of ethical self-denial.

Varia. Studies on Problems of Philosophy and Ethics, by WILLIAM KNIGHT. John Murray, London, 1901. pp. 196.

The functions of philosophy at the present time; nationality as an element in its evolution; our present philosophical outlook; poetry and science, their contrasts and affinities; the unseen root of ethics; the correlation of moral forces; corporate responsibility; practical ethics; philosophical societies in the universities of Scotland; the formation of public opinion; desiderata in modern philosophy and the ethics of criticism, are the topics in this volume, made up of lectures to students at St. Andrews, one of which is given at the opening of each year.

Ethical Marriage. A Discussion of the Relations of Sex from the Standpoint of Social Duty, by DELOS F. WILCOX. Wood-Allen Publishing Co., Ann Arbor, Mich., 1900. pp. 235.

This little book embodies a protest against the idea that the morals of marriage are a subject to be discussed by physicians alone and as incidental to sexual pathology. The writer pleads that marriage is the supreme co-operation; that only the fittest should marry; describes its motives, the duties of courtship, the control of passion in marriage, with social reflections at the end.

Sexualsittik, Sexualjustiz, Sexualpolizei, von KARL KENTSCH. "Die Zeit," Wien, 1900. pp. 95.

Das Sexuelle Leben der Naturovölker, von JOSEF MÜLLER. Lampart u. Comp., Augsburg. pp. 73.

Sexuelle Irrwege, von FERD. STEINGESSER. Hugo Bermühler, Berlin, 1901. pp. 192.

These volumes are hardly scientific or philosophical, but are chiefly popular, and while they contain some things that are good, contain little that is new.

Questions de Philosophie Morale et Sociale, par J. P. DURAND. F. Alcan, 1901.
pp. 179.

The venerable writer again describes materialism, atheism, determinism, socialism, transformism, and "struggleforlifeism," with an appendix on the relations of psychology to metaphysics, morals and the subconscious, and the communal family.

The Doctrine of the Freedom of the Will in Fichte's Philosophy, by JOHN FRANKLIN BROWN. Richmond, Ind., 1900. pp. 105.

The Ethical Aspect of Lotze's Metaphysics, by VIDA F. MOORE. The Macmillan Co., New York, 1901. pp. 101.

These are interesting and valuable digests of their themes, which speak well for the high quality of the work done in the Philosophical Department of Cornell University, where both were produced.

Friedrich Nietzsche, von JULIUS REINER. Hermann Seeman, Leipzig, 1901. pp. 76.

His life and work as poet and philosopher are first described, and the latter is treated under the captions of religion, woman, the superman and morality.

Lectures on the History of Physiology during the Sixteenth, Seventeenth and Eighteenth Centuries, by M. FOSTER. University Press, Cambridge, 1901. pp. 310.

These lectures were delivered in the autumn of 1890 at the Cooper Medical College in San Francisco. The writer does not attempt to give a complete history of physiology, even within the period to which he has limited himself, but has selected certain themes that seem to him most striking and important. He has woven in interesting stories of the lives of Vesalius, Harvey, Borelli, Malpighi, Van Helmont, Sylvius, and other writers.

La Morale basée sur la Démographie, par ARSÈNE DUMONT. Schleicher Frères, Paris, 1901. pp. 181.

The chapters are entitled the crisis of morality, the crisis of modern science, the demographic criterion, the love of truth, alcohol, and moralization.

Inductive Sociology, by FRANKLIN H. GIDDINGS. The Macmillan Co., New York, 1901. pp. 302.

This book presents a scheme of inductive method, a detailed analysis and classification of social facts, and a tentative formulation of the more obvious laws of social activity,—all as a basis for further inductive studies. The first book treats the elements of social theory; the second, the elements and structure of society. Under the latter, part one deals with the social population; part two, the social mind; part three, organization; and part four, welfare.

The Primer of Political Economy, by S. T. WOOD. The Macmillan Co., New York, 1901. pp. 149.

This volume seeks to lay ground work for political study and explain some of the actual economic phenomena passing through our hands from day to day that their laws, principles and relationships may be more independently studied and more clearly understood. They are addressed to the fourth form of public schools and treat the herdsman of the plains; how oil is obtained; mining, rubber, shoemaking, taxation, coin, banking, stock companies, and many other topics.

Select Documents of English Constitutional History, edited by George Burton Adams and H. Morse Stephens. The Macmillan Co., New York, 1901. pp. 555.

This is to meet the needs of teachers of English constitutional history. The great question in this work, as the previous English selections by Stubbs, Frothero and Gardiner have shown, is to make the proper selection. These authors have followed a plan of their own, and we think with wisdom and discretion.

Notre Armée, von ÉMILE MANCEAU. Bib. Charpentier, Paris, 1901. pp. 425.

This psychological study of the French army considers first the officers, the methods of recruiting, advancement, their relations to the nation; then the sub-officers and soldiers, the instruction of the latter and the duration of military service. The spirit of French military institutions, the constitution of the army, and other topics are treated.

Psychologie d'une Ville, par H. FIERENS-GEVAERT. F. Alcan, Paris, 1901. pp. 189.

This is a psychological study of the town of Bruges, and describes the birth and adolescence of the city, its art, men and events of the thirteenth century, its democracy, realism, painting, luxury, moral life, architecture, etc.

Die Religionen der Völker, von H. BERKENBUSCH. A. Kiepert, Hannover, 1901. pp. 100.

This pamphlet discusses the religion of Babylonians, Phoenicians, Canaanites, Israelites, Arabians, Egyptians, Chinese, East Indians, Iranians, Greeks, Romans, and Germans.

Die Anfänge unserer Religion, von PAUL WERNLE. J. C. B. Mohr, Tübingen, 1901. pp. 410.

Under the origin of religion are discussed Jesus, his calling, the promise, his function as redeemer, the primitive Christian community, Paul, the theology of redemption, the anti-Judaic apologetics, the apocalypse, the development of the church and theology, and piety in the post-apostolic age.

Magic and Religion, by ANDREW LANG. Longmans, Green and Co., New York, 1901. pp. 316.

This is the nineteenth volume of this voluminous author and editor, which the Longmans have published. The writer points out in the first paper the danger of allowing ourselves to be led astray by too ingenious hypotheses. The next two papers strengthen his well known theory that the first traceable form of religion was high and was lowered in the process of evolution. He still polemizes in the forty-five pages against Taylor and Frazer. South African religion, taboos, the ghastly priest, fire walk, cup and ring, cavalry;—these constitute the most important papers.

Die Entwicklung der Religionsbegriffe als Grundlage einer progressiven Religion, von STEFAN VON CZOBEL. Vol. I, pp. 578; Vol. II, Part 1, pp. 288. Lotus-Verlag, Leipzig, 1901.

The writer premises that religion begins in the origin of supersensual ideas and a belief in supernatural beings, and gives what he terms a rational formulae of development, and then treats successively the religion of the Akkadians, Egyptians, Assyrians, Phoenicians, Jews, Medes, Persians, Indians, Greeks, Romans, and finally Christianity. It is a unique attempt to regard the religions of ancient and modern times from the standpoint of evolution.

The Old Testament from the Modern Point of View, by L. W. BATTEN. E. S. Gorham, New York, 1901. pp. 354.

The writer first treats the general arguments against the validity of critical results, then the hexateuch, history, prophets, and psalms, with a final chapter on criticism and the supernatural.

The Life and Literature of the Ancient Hebrews, by LYMAN ABBOTT. Houghton, Mifflin and Co., Boston, 1901. pp. 408.

The chief topics are the Bible as literature, Hebrew history, prehistoric traditions rewritten, book of the covenant, the Deuteronomic code, the canon law, Hebrew fiction, stories retold, a drama of love, a spiritual tragedy, a school of ethical philosophy, a collection of lyrics, preachers of righteousness and redemption, the message of Israel. Two tables, one giving the order of the writings of the Old Testament and the other its chronology, are prefixed.

Leben Jesu, von D. OSCAR HOLTZMANN. J. C. B. Mohr, Tübingen, 1901. pp. 428.

This is a very judicious and learned summary of the sources, turning points, early history, the Baptist, Jesus' baptism, temptation, the nearness of the kingdom, the preaching in Galilee, the calling of the Twelve, the visit to Jerusalem, proclamation as Messiah, death and resurrection.

Studies of the Mind in Christ, by THOMAS ADAMSON. T. and T. Clark, Edinburgh, 1898. pp. 300.

What was the knowledge which our Lord had as a man is a question which can be investigated without disrespect to Christ? We are not at liberty to believe that divinity did the work of humanity or in any respect rendered it less human. From this point of view our author discusses Christ's ignorance; his real and apparent supernatural knowledge; his divine and spiritual knowledge; his knowledge of the Old Testament; of the future; the boundedness of his knowledge; his self guidance; plan; his traits as a miracle worker; and his mental identity after his resurrection.

Is Christ Infallible and the Bible True? by HUGH M'INTOSH. T. and T. Clark, Edinburgh, 1901. pp. 719.

The question which forms the title of this book is for the author the supreme and most urgent question in the world. He does not hold to absolute inerrancy, but throughout his teaching is highly conservative. His work is essentially argumentative, and is directed mainly against the leaders of the liberal school.

The Divinity of Christ. An Argument. Translated from the French of Mgr. Emile Bougaud, by C. L. Currie. William H. Young and Co., New York, 1901. pp. 159.

The author here seeks to present Christianity in a form suited to the present time. He desires to describe its polity and unfold its creed, and assumes throughout that religion only requires to be known to be welcome. It was written when the author was about fifty, and is the product of a soul overflowing with benignity and adoration. The substance of its ten chapters was no doubt often preached, and their point of view is somewhat hortatory.

Jesus Christ and the Social Question, by FRANCIS GREENWOOD PEABODY. The Macmillan Co., New York, 1901. pp. 374.

These seven chapters are somewhat sermonesque, but abound in indications of the author's study of the problems of modern social life, and are predominantly a study of the views of Jesus.

The Historical New Testament. A new translation by James Moffatt. Charles Scribner's Sons, New York, 1901. pp. 726.

The writer has arranged the New Testament in the order of its literary growth and indicated at the same time the chief grounds upon which such order is determined. He has also given us a new translation. It is difficult to speak too highly of the care with which this work is executed. The writer has taken pains to possess himself of most of the authorities and theories bearing upon the subject. His introductions are succinct, and he has constructed many very interesting tables which are perhaps on the whole the best thing in the volume, which ought to be in the possession of every student of the New Testament.

Ad. Harnacks Wesen des Christentums für die christliche Gemeinde geprüft, von D. WILH. WALTHER. A. Deichert, Leipzig, 1901. pp. 168.

This volume, larger than that to the refutation of which it is devoted, Harnack calls the best and ablest of all the many attacks upon his famous lectures to students. The author is the Professor of Theology at Rostock, and especially attacks Harnack's disbelief in miracles; his statement that Jesus brought no essentially new message; that he does not exactly belong in his own gospel; did not arise from the dead; that his death was not an atonement; and that Paul in some respect injured the gospel.

Das Christentum, von D. Ad. Harnack nach dessen sechzehn Vorlesungen, von ED. RUPPRECHT. E. Bertelsmann, Gütersloh, 1901. pp. 278.

These sixteen lectures contain an exceptionally pietistic refutation of Harnack, who is overwhelmingly refuted by dogmatic assertions and well rebuked and reproved.

Das Wesen des Christentums und die Zukunftsreligion, von LUDWIG LEMME. Edwin Runge, Berlin, 1901. pp. 218.

These seventeen discourses on Christian religiosity and the absolute, or future religion, are essentially evangelical. The student and the pietist will find little new here.

The Soul of a Christian, by FRANK GRANGER. The Macmillan Co., New York, 1900. pp. 303.

The writer has saturated himself with Christian mysticism, and has taken some, though too slight, account of modern psychology, and writes chapters on the oversoul, the depths of the soul, its awakening, its dark night, ecstasy, vision and voices, human and divine love, symbol and ritual, inspiration and prophecy, illumination and progress, confession, casuistry mystical theology. He is a man who has had deep religious feeling, and has struggled and groped his way to profound insights and made interesting points of contact between the best type of mysticism and modern psychology. For all those interested in the new field here opening, this volume will be very stimulating, although very unsatisfying.

Christentum und Darwinismus in ihrer Versöhnung, von HERMANN FRANKE. A. Duncker, Berlin, 1901. pp. 128.

This was suggested by Harnack's famous lectures on the essence of Christianity. Accepting this view in the main, the writer contrasts it with evolutionism, but finds that the more liberal the views of Christianity become, the more they harmonize with the development hypothesis. This is traced in the evolution of religion, of revelation, of Christianity, and of morals.

Das Christentum als Religion des Fortschritts, von CHR. A. BUGGE. J. Ricker, Giessen, 1900. pp. 67.

The writer proves his thesis in two ways, both treated in an inspiring way; first, the social programme of Paul, and second, the inspiration of the Bible.

Enthusiasmus und Bußgewalt beim Griechischen Mönchtum, von KARL HOLL. J. C. Hinrichs, Leipzig, 1898. pp. 331.

Enthusiasm among the Greek monks; the discipline of penance and confession are the topics of chief interest here treated.

Monuments of the Early Church, by WALTER LOURIE. The Macmillan Co., New York, 1901. pp. 432.

This interesting volume is fully up to the level of the other six hand-books of archaeology and antiquities, which have so far appeared. Christian cemeteries, the basilica, pictorial art, early painting, sculpture, mosaics, miniatures, the minor arts, and ecclesiastical dress are the leading topics, with 182 illustrations.

Theologie und Metaphysik, von GEORG WOBBERMIN. A. Duncker, Berlin, 1901. pp. 291.

The first part treats of epistemological investigation concerning the idea of metaphysics and its significance for theology. The second part treats of *empirio* criticism as the outcome and self criticism of anti-metaphysical thought as treated from the standpoint of theological interest. The third part deals with the fundamental problems of metaphysics and their importance for theology, especially the problem of the self and causality.

Die Idee des Reiches Gottes in der Theologie, von JOHANNES WEISS. J. Ricker, Giessen, 1901. pp. 155.

This is an amplified lecture delivered at a theological conference in Giessen, and is in a sense supplementary to the author's treatise on Jesus' teachings concerning the Kingdom of God.

La Vie future d'après le Mazdésisme, par NATHAN SÖDERBLOM. (Annales du Musée Guimet, Vol. IX.) Ernest Leroux, Paris, 1901. pp. 447.

This study of comparative eschatology is one of the best of the many excellent productions of this unique institution.

A Century's Progress in Religious Life and Thought, by W. F. ADENEY. Jas. Clarke and Co., London, 1901. pp. 229.

The chief topics here treated are the Oxford movement; the relations between religion and science; Biblical criticism; the imminence of God; the decline of Calvinism; changed views of redemption; with other chapters on preaching and preachers; leading minds of the century, etc. The writer has evidently lived into his subject long and well.

Glauben und Wissen, von EMIL FISCHER. Handel, Bamberg, 1901. pp. 232.

The chief topics are Japanism; woman as a teacher; Goethe's relation to religion; Bible criticism and religious education; the death penalty; is there a life end or purpose? patriotism and Tolstoi, anarchy, faith and knowledge; what is going to happen?

La Crise de la Croyance, par ALBERT BAZAILLAS. Perrin et Cie, Paris, 1901. pp. 307.

The philosophy of certitude and of life according to Olle-Lapreune; the life of belief according to Newman and Arthur Balfour;—these are

the topics in a volume made up of the publication of nine articles here reprinted from recent periodicals.

Die ewigen Wahrheiten im Lichte der heutigen Wissenschaft, von WERNER A. STILLE. R. Friedländer und Sohn, Berlin, 1901. pp. 91.

We have here a study of the theory of knowledge in a somewhat popular form, wherein the writer discourses upon the basal elements of philosophy, the superphysical as seen, e. g., in the laws of number, geometry, and in the physical world, with a final discussion of space, time, materialism and idealism.

Der Wahrheitsgehalt der Religion, von RUDOLF EUCKEN. Veit und Comp., Leipzig, 1900. pp. 448.

The foundation of a universal religion seems to the author to impend, but it encounters obstacles in nature, culture and the uncertainties concerning man's position in the world. He next discusses the future development of the race and the contents of its characteristic religion, and finally distinguishes between the eternal and temporal in Christianity.

The Contents of Religious Consciousness, by JAMES H. LEUBA. *Monist*, July, 1901.

This very interesting article should be read in connection with the author's introductory paper in the *Monist* for January. It is a continuation of his studies in the psychology of religion begun in this journal, Vol. VII, p. 397. It is largely taken up with a description of fourteen interesting typical cases.

Public Worship. A Study in the Psychology of Religion, by JOHN P. HYLAN. Open Court Publishing Company, Chicago, 1901. pp. 94.

This is a thesis for the degree of Ph. D. in Clark University, and is one of the increasing number of studies of religious psychology issued by past and present students here. It is based to some extent upon questionnaire returns, but the writer has given much attention to the literature of the subject, and appends a valuable bibliography. Worship for him is a device for developing the moral control of conduct, and this study was undertaken in order to shed light upon the problem why our churches are not more efficient. An attempt is made to evaluate the modern aesthetic type of worship, and also to explore the influence of science upon religion, which is defined as a feeling of personal responsibility toward the conditions of the environment.

This work, with the volume of Starbuck, the various papers of Leuba, the studies of Daniels, Dawson, Lancaster, Kline and others, are the first fruits of one of the promising new directions of work at Clark University to apply psychology to religion.

Early Conversion, by E. PAYSON HAMMOND. J. S. Ogilvie Publishing Co., New York. pp. 232.

This noted child revivalist has here given us an interesting account of his work, the design of which is to show how young people can be early prepared for church membership, with many practical illustrations and stories, and is dedicated to all who believe in early conversion.

The School Hymnal. The Presbyterian Board of Publication and Sabbath School Work, Philadelphia, 1900. pp. 283.

The Presbyterian Board herein completes its series of hymnals intended to cover the whole sphere of public worship in church, chapel and school.

For Sunday School Workers, by A. F. SCHAUFLER. With a foreword by the late Dwight L. Moody. W. A. Wilde Co., Boston, 1901. pp. 283.

Like all the author's other publications, this book is largely made up of talks to Sunday School teachers. The last half of the book is in part written by other hands, and Rev. A. H. McKinney contributes three interesting chapters on the study of the child. On the whole it is a volume of devices and exhortation, and deals little with pedagogical principles.

Mission Problems and Mission Methods in South China, by J. CAMPBELL GIBSON. Oliphant, Anderson and Ferrier, Edinburgh, 1901. pp. 332.

These are lectures given by appointment of the General Assembly of the Free Church of Scotland. Interesting are the chapters on Chinese literature, philosophy and religion, and the first three stages of mission work. The writer's field of view is limited to that of the English Presbyterian mission. The book contains sixteen illustrations.

Das Spätere Judentum als Vorstufe des Christentums, von W. BALDENSPERGER. J. Ricker, Giessen, 1900. pp. 30.

Das Biblische Paradies, von B. POERTNER. Franz Kirchheim, Mainz, 1901. pp. 36.

Die Offenbarung im Gnosticismus, von RUDOLF LIECHTENHAN. Vandenhoeck und Ruprecht, Göttingen, 1901. pp. 168.

Kultus- und Geschichtereligion, von JOH. JUNGST. J. Ricker, Giessen, 1901. pp. 79.

Die Motive des Glaubens an die Gebetserbörung im Alten Testament, von JUSTUS KÖBERLE. A. Deichert, Leipzig, 1901. pp. 30.

Die Geburts- und Kindheitsgeschichte Jesu Luc. 1,5-11, 52, von A. HILGENFELD. pp. 177-235.

Das Wesen des Christentums, von GEORG REINHOLD. Jos. Roth, Stuttgart, 1901. pp. 96.

Beiträge zur Geschichte und Erklärung des Neuen Testaments, von C. F. GEORG HEINRICI. Dürr, Leipzig, 1900. pp. 81.

Lehrbuch der Neutestamentlichen Theologie, von HEINRICH JULIUS HOLTZMANN. Vol. II, pp. 532. J. C. B. Mohr, Freiburg, i. B., 1897.

Zwei akademische Vorlesungen über Grundprobleme der systematischen Theologie, von GEORG WOBBERMIN. Alex. Duncker, Berlin, 1899. pp. 43.

Das Mönchtum seine Ideale und seine Geschichte, von ADOLF HARNACK. J. Ricker, Giessen, 1901. pp. 60.

The Philosophy of Religion in England and America, by ALFRED CALDECOTT. The Macmillan Co., New York, 1901. pp. 434.

Die Selbständigkeit der Dogmatik gegenüber der Religionsphilosophie, von LUDWIG IHMELS. A. Deichert, Leipzig, 1901. pp. 34.

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